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VOL. XI. MED——MID

INDOCTI DISCANT, ET AMENT MEMINISSE PERITI.

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ENCYCLOPÆDIA.

MEDALS.

Utility of them in History, &c.

MEDAL, denotes a piece of metal in the form of coin, such as was either current money among the ancients, or struck on any particular occasion, in order to preserve to posterity the portrait of some great person, or the memory of some illustrious action. Scaliger derives the word *medal* from the Arabic *methalia*; a sort of coin with a human head upon it. But the opinion of Vossius is generally received; viz. that it comes from *metallum*, "metal;" of which substance medals are commonly made.

SECT. I. *Utility of Medals in History, and various other Sciences.*

THERE are few studies of more importance to history than that of medals; the sole evidence we can have of the veracity of an historian being only such collateral documents as are evident to every body, and cannot be falsified. In modern times, these are found in public memoirs, instructions to ambassadors, and state papers of various kinds. Such memorials, however, are subject to various accidents, and besides commonly remain in the countries where they are first published, and cannot therefore give to the world at large that perfect and entire satisfaction which ought to be derived from genuine history; so that more durable and widely diffused monuments are still to be wished for. Such are public buildings, inscriptions, and statues; but these, excepting a few instances of the two last, are always confined to particular countries: so that medals alone remain as infallible documents of truth, capable of being diffused over all countries in the world, and of remaining through the latest ages.

1 Various writers on medals.

The first who showed the importance of medals in ascertaining the dates, and arranging the order of events, in ancient history by means of medals, was Vaillant, in his History of the Kings of Syria, printed at Paris in 1681. By medals alone, he has been enabled to fix the chronology and important events of history, in the three most ancient kingdoms of the world, viz. Egypt, Syria, and Parthia. Many coins have been discovered since his time, which confirm the accounts he has given. He was followed in this method by Father Hardouin, though with less success. Hardouin's best work is his *Herodiades*, or Series of Successors to Herod king of Judæa. The same plan was pursued by Noris, in his learned Treatise on the Syro-Macedonian princes, and by Bayer in his History of Osrhoene, as well as by Froelich, in the work intitled *Annales Regum et Rerum Syriæ*, Vien. 1754, and another named Kevenhullers *Regum veterum Numismata Anecdota auctore Perrarà*, Vien. 1752, 4to, of which Froelich was properly the author. Corsini and Cary likewise published works of a similar nature; the former in 1744, *De Minnisari, aliorumque Armeniæ Regum, Nummis*, &c.; the latter 1752, *Histoire des Rois de Thrace, et du Bosphore Cimmerien, eclaircie par les Medailles*.

2 Of the Greek coins.

The study of the Greek coins does not show the dates of events, though it illustrates the chronology of reigns. This defect, however, is abundantly supplied by those of Rome, which commonly mark the date of the prince's consulship, the year of his tribunician power; giving also, upon the reverse, the representation or poetical symbol of some grand event. The year of the tribunician power is sometimes imagined by antiquaries to be synonymous with that of the emperor's reign: but this is not the case; and Mr Pinkerton is at some pains to set them right in this respect. He finds fault with Julius Cæsar, when he assumed the sovereign authority, for taking upon him the title of Perpetual Dictator, as being synonymous with that of king or absolute governor, which the Romans abhorred. "He ought (says our author), under the disguise of some supreme magistrate of annual election, to have lulled the people with a dream, that they might terminate his power when they pleased; or that he himself would resign it, when the necessities of state which had required his temporary elevation had subsided." To this error Mr Pinkerton ascribes the assassination of the Dictator, and commends the policy of Augustus, who, with far inferior abilities, continued in possession of the most absolute authority as long as he lived. The tribuneship was an office of annual election; and if put into the hands of any others than plebeians, must have been the supreme power of the state, as it belonged to that office to put a negative upon every public measure whatever. Augustus, being of senatorial rank, could not assume this office; but he invested himself with the tribunician power, which had the advantages of appearing to be only a temporary supremacy, though in truth it was continued during his whole lifetime. Towards the end of his reign, he frequently assumed his destined successor, Tiberius, for his colleague, though in the beginning he had enjoyed it alone. This, with his artifice of resigning his power every ten years, and

3 Method used by Augustus to secure his power.

Utility of them in History.

re-assuming it at the desire, as was pretended, of the senate, secured his sovereignty as long as he lived.—His example was followed by his successors; so that most of them have the inscription *Tribunicia Potestate* upon their medals, with the date affixed to it thus *Tr. Pot.* VII. Yet though this date generally implies the year of the emperor's reign, it sometimes happens that the emperor, by special favour from a former prince, had been endowed with this title before he came to the throne, as being the successor to that prince, of which we have already given an instance in Tiberius. Besides the tribunician power, the emperors very frequently enjoyed that of the consuls; and the date of their consulship is frequently expressed in their coins.

The office of Pontifex Maximus was likewise assumed by the Roman emperors in order to secure themselves in their authority; which, Mr Pinkerton observes, was one of the most efficacious artifices they could have fallen upon. "In the Greek heroic times (says he), king and priest were carefully united in one person; and when sovereigns arose in Denmark and Sweden, the same plan was followed, as appears from Snorro, and other writers. Nothing could lend more security to the person of the monarch than an office of supreme sanctity, which also confirmed his power by all the terrors of superstition. Even the Christian system was afterwards debased by a mock alliance with government; though it be clear from the whole New Testament, that such an alliance is subversive of its genuine institution, and the greatest of all its corruptions. But the Roman Catholic clergy, in the dark ages, were the authors of 'no church no king,' for their own interest; while the Roman emperors only sought to strengthen their power by the dark awe of superstition. The title of Pontifex Maximus was so important, that it was retained even by the Christian emperors till the time of Gratian. Its influence in the state was, indeed, prodigious. Cicero observes, that to this office were subject temples, altars, penates, gods, houses, wealth, and fortune of the people.—That of augur is also borne by many emperors; and its authority was such, that by the law of the twelve tables no public business could be transacted without a declaration from the augur concerning its event.—The pro-consular power was also given to Augustus and the other emperors. It conferred a direct authority over all the provinces, and implied the emperor to be chief pro-consul, or governor of each, and of all. Another special power assigned to the emperors, but not occurring on coins, was the *Jus Relationis Tertiæ, Quartæ*, &c. or the right of making three or four motions in the senate on the same day, while the senators could only propose one.

Hence our author infers that medals afford the most authentic documents of the Roman history, in particular, that could have been invented by man.—The histories of Nerva and Trajan are much better elucidated by medals than by authors; for the history of Suetonius ends with Domitian, and the *Historiæ Augustæ Scriptores* begins with Adrian: so that the reigns of the two emperors just mentioned are almost unknown; and Mr Pinkerton is surprised that none of the learned have attempted to supply the defect.—"Capitolinus (says he), in his life of Maximinus Junior, is quite puzzled to know if Maximus and Pupienus were two emperors, or two names for the same. Had he happened on any of those coins which bear M. Cl. Pupienus Maximus Aug. he would have seen at once that Maximus was only another name for Pupienus.'

Utility of them in History, &c.

4 Use of medals in geography.

Medals are useful in other sciences besides history. In geography, we find the situation of towns determined by their vicinity to some noted river, mountain, &c. Thus, ΜΑΓΝΗΤΩΝ ΣΙΠΥΛΟΥ shows that Magnesia was situated under Mount Sipylus. In like manner, it is shown from a medal, that Ephesus stood on the river Cayster; and there is extant a medal, bearing an inscription, which signifies Alexandria on the Scamander; a name given to Troy by Alexander the Great. The reverse has upon it the famous Apollo Smintheus of Homer. In natural history, also, medals are useful chiefly from the coins struck on the celebration of the secular games, in which the figures of various animals are preserved; and thus it may very often be determined whether any animal be known to the ancients or not. On many of the Greek medals are several uncommon plants and animals. Thus, on most of the medals of Cyrene is the figure of the celebrated *Sylphium*; and on those of Tyre, the shell-fish from which the famous Tyrian purple was procured. By means of medals, also, the exact delineations of many noble edifices are preserved, though not even a vestige of their ruins be now existing; so that the uses of them to the architect are very considerable. To the connoisseur they are absolutely necessary; because by them alone he is enabled to ascribe ancient busts and statues to their proper persons, with multitudes of other points of knowledge which cannot be otherwise determined. The elucidations of obscure passages in ancient authors by means of medals, are so numerous and well known, that it is needless to insist upon them.

5 In natural history.

6 In architecture.

7 In the fine arts.

Mr Addison has treated the connection betwixt medals and poetry at considerable length; but Mr Pinkerton finds fault with him for preferring the Latin to the Greek poets. He observes also, that the knowledge of Greek medals is most necessary for a sculptor, and perhaps an architect; but an acquaintance with Latin ones is preferable for a poet, or perhaps a painter. The reason of this difference is, that the former generally have on the obverse the head of some king, god, or goddess, of exquisite relief and workmanship; but the reverse seldom affords much fancy of symbol in the early Greek coins; and in the imperial Greek coins, is chiefly impressed with the temples of their deities. To a person of poetical imagination, however, the Roman coins afford the greatest entertainment, from the fine personifications and symbols to be found on their reverses; of which our author gives the following instances.

8 Latin medals of use to a poet.

9 Personifications on Roman medals.

"Happiness has sometimes the caduceus, or wand of Mercury, which Cicero, 1. *Offic.* tells us was thought to procure every wish. She has in a gold coin of Severus heads of poppy, to express that our prime bless lies in oblivion of misfortune.

"Hope is represented as a sprightly girl, walking quickly, and looking straight forward. With her left hand

Utility of them in History, &c.

hand she holds up her garments, that they may not impede the rapidity of her pace; while in her right hand she holds forth the bud of a flower; an emblem infinitely more fine than the trite one of an anchor, which is the symbol of Patience and not of Hope. This personification, with some others, must have been very familiar to the ancients; for often in this and in a few more instances, no name, as SPES AUG. or the like, is inserted in the legend.

"ABUNDANCE is imagined as a sedate matron, with a cornucopia in her hands, of which she scatters the fruits, and does not hold up her cornucopia and keep the contents to herself, as many modern poets and painters make her do.

"The emperor Titus, having cause to import a great supply of corn during a scarcity at Rome, that supply, or the ANNONA, is finely represented as a sedate lady, with a filled cornucopia in her left hand, which she holds upright, to indicate that she does not, however, mean to scatter it, as Abundance has a title to do, but to give it to Equity to deal out. This last particular is shown by her holding a little image of Equity, known by her scales and *hasta pura*, or pointless spear, in her right hand, over a basket filled with wheat. Behind the ANNONA is the prow of a ship decked with flowers, to imply that the corn was brought by sea (from Africa), and that the ships had had a prosperous voyage. The best poet in the world would not have given us a finer train of imagery; the best painter would have been puzzled to express so much matter in so small a compass.

"SECURITY stands leaning upon a pillar, indicative of her being free from all designs and pursuits; and the posture itself corresponds to her name. Horace, in describing the wise man, mentions his being *teres atque rotundus;* round and polished, against all the rules of chance: an idea seemingly derived from the column upon which this ideal lady reclines.

"The emblems of PIETY, MODESTY, and the like, are equally apposite and poetical.

"The happiness of the state is pictured by a ship sailing before a prosperous breeze: an image than which the superlative genius of Gray could find none more exquisite; and he has accordingly used it in his most capital production "The Bard," with due success.

"The different countries of the then known world are also delineated with great poetical imagery. It affords patriotic satisfaction, particularly to a Briton, to see his native island often represented upon the earliest imperial coins sitting on a globe, with a symbol of military power, the *labarum* in her hand, and the ocean rolling under her feet. An emblem almost prophetic of the vast power which her dominion over the sea will always give her, provided she exerts her element of empire with due vigour and perseverence.

"Coins also present us with Achaia, Africa, Alamannia, Alexandria, Arabia, Armenia, Asia, Bithynia, Cappadocia, Dacia, Dardania, Egypt, Gallia, Hispania, Italia, Judæa, Macedon, Mauritania, Pannonia, Parthia, Phrygia, Sarmatia, Sicily, Scythia, Syria, and the rivers Danube, Nile, Rhine, Tyber. This personification of provinces seems to have arisen from the figures of provinces carried in triumphs; as the personification of our old poets sprung from the ideal persons actually represented in the mysterial plays.

"There is one colonial medal of rude execution of Augustus and Agrippa, which has a high claim to merit in displaying the ancient poetical imagery. It is inscribed IMP. and DIVI. F. and on the reverse, the conquest of Egypt is represented by the metaphor of a crocodile, an animal almost peculiar to that country, and at that period esteemed altogether so; which is chained to a palm-tree, at once a native of the country, and symbolic of victory.

10 Medals useful to a painter.

"As the reverses are so useful for knowledge of personification, symbols of countries and actions, and the like; so the portraits to be seen on old coins are no less important to a painter; the high merit of a great number of them, in every character, justly intitling them to be regarded as the best studies in the world. Not to mention, that, to an historic painter, the science of ancient medals is absolutely necessary, that he may delineate his personages with the features they really bore while in existence. This can only be attained in this way, or from statutes and busts; any one of which will cost as much as hundreds of medals; and indeed a collection of such is only attainable by princes."

11 To a sculptor.

The same things which render the study of medals important to a painter, do still more so to a sculptor; and in this particular, the study of the Greek coins is remarkably useful. The skill of the Greeks in the art of sculpture has always been admired throughout the world; and on their coins the heads of several deities are represented in the most exquisite *alto-relievo*. Our author therefore thinks it strange, that the Grecian coins should have hitherto been so little attended to by men of learning and taste. They may have been looked upon, he supposes, as belonging only to the province of the antiquary; but he assures us, that the Greek medals will afford satisfaction to the persons who value them only as pieces of workmanship. In most respects, they greatly excel those of Rome even in its best times; which our author supposes to have been from the days of Augustus to Adrian. "In the days of Adrian, in particular (says he), the Roman mint seems to have been the very seat of art and genius; witness the vast number of exquisite personifications, engraven with equal workmanship, which swarm on the medals of that prince. Yet from his time down to Posthumus, coins of admirable workmanship are to be found. Those of the Faustinas and Lucilla deserve particular mention. There is one, and not an uncommon one, of the latter in great brass, which yields to nothing of the kind. The reverse is a Venus with the name around her. The portrait of the obverse seems to spring from the field of the coin; it looks and breathes, nay talks, if you trust your eyes. The coins of Tarsus are extremely remarkable for a kind of perspective in the figures, as Froelich observes. On others are found triumphal arches, temples, fountains, aqueducts, amphitheatres, circi, hippodromes, palaces basilicas, columns and obelisks, baths, sea-ports, pharoses, and the like. These furnish much pleasure and instruction to the architect, and serve to form his taste to the ancient manner; that manner which unites perfect simplicity with sublimity and grace; that manner which every

Entertainment from studying them.

age admires, in proportion as it has genius to imitate."

Sect. II. *Entertainment arising from the study of Medals.*

Besides the purposes which the study of medals answers in the useful arts, a great variety of sources of entertainment are to be found in it. Mr Pinkerton observes, that the most barbarous nations are more pleased with the rudest efforts of art, than with the most admirable works of nature; and that in proportion as the powers of the mind are large and various, such are also the pleasures which it receives from those superlative productions of art, which can only be the offspring of vast genius. Hence works of art are agreeable both to the enlightened and to the ignorant. The chief amusement, therefore, which attends the study of medals, originates from the strength and spirit, the finish and beauty, which the engraver has displayed in the execution of them. It besides gives a kind of personal acquaintance with the persons of whom they are the representations. Portraits have always been highly entertaining to mankind; and our author is of opinion, that the love of them gave rise both to painting and sculpture. They are no where to be found so ancient, numerous, and so well preserved as in medals. Amusement is also derived even from the representations of ideal heads and persons; nay, even from the minutest symbols. Thus the Greek coins of cities present us with heads of deities of exquisite workmanship, apparently copied from statues or paintings; so that we may even guess at the works of Apelles and Praxiteles from some of the Greek medals. Their reverses afford still greater variety; there being scarce an object either in art or nature which is not represented upon some of them: and to the satisfaction arising from a view of these, we may likewise add that of beholding, in a lively manner, the dresses, manners and customs, religious and civil ceremonies, of the ancients: so that from medals we may obtain an interesting history of manners; which, though very lately cultivated, may perhaps afford the most useful and entertaining of all the provinces of history.

12 Difference betwixt a medallist and antiquary.

There is a very considerable difference betwixt the study of medals and that of a mere antiquary. The latter frequently seems to take delight in coins merely in proportion to their rust and deformity; so that it is often a recommendation of some of their pieces, that neither portrait, reverse, nor legend, can be discovered; at least in such manner as can be intelligibly explained. "The delight of the antiquarist (says Mr Pinkerton) may be called a depraved appetite of the mind, which feeds on trash, and fills itself with emptiness. It is perhaps a mere childish curiosity mingled with caprice and hypochondricism. Against this character the ridicule of Severus is particularly shot, but with little effect; for our antiquists exceed in visions and nonsense. I say *antiquists;* for the name of antiquary is sacred. By *antiquary*, in foreign countries, is implied a man who illustrates their ancient laws, manners, poetry, but especially their ancient history. There men of the most elevated minds are antiquaries; as Muratori, Leibnitz, Montesquieu, Du Bos. Here men of talents must not stoop, forsooth, to studies the most important to their country, but leave its antiquities to chance. Every thing is important but our history; and we are profound in every ancient matter that is superficial; and superficial in what is profound. Even England cannot boast of one general historian, but trusts to the inaccuracy of Rapin, and the ignorant neatness of Hume. It is therefore no wonder that the study of antiquity is here ridiculous, though most important in other countries; none requiring greater talents, learning, or industry. But the historic antiquary has the pleasure of benefiting society, and enlightening whole nations, while the medallic has only an innocent amusement. This amusement, considered merely as rising from antiquarian objects, has not been explained, though felt by most people, and more by the learned. It seems analogical with that which we derive from an extensive prospect: for as the mind delights to expand itself into distant places, so also into distant times. We connect ourselves with these times, and feel as it were a double existence. The passions are singularly affected by minute circumstances, though mute to generalities; and the relicts of antiquity impress us more than its general history."

History.

Sect. III. *History of Medals.*

The study of medals is not of very ancient date: None of the classic writers give any account of collections of them; though indeed many little particulars are passed without notice by them. In the times of the Greeks, a collection of such coins as then existed must have been but little regarded, as consisting only of those struck by the numerous little states which at that time used the Greek characters and language. Hence they would have had an air of domestic coinage, and no attention would have been paid to them, however exquisite their workmanship might have been. The little intercourse at that time carried on betwixt the different provinces also, greatly impeded any communication of knowledge to those who wrote histories; so that it is no wonder to find any small collections that might then have existed altogether unnoticed by them.

13 Greek coin imitated by the Romans.

Almost as soon as any communication was opened between the Greeks and Romans, the latter treated the arts of the Greeks with all due respect and applause. Their coins were imitated by the Romans, and preserved in cabinets by the senators among their choicest treasures. Suetonius informs us, that on solemn occasions Augustus was accustomed to present his friends with medals of foreign states and princes, along with other valuable testimonies of his friendship. In a more advanced period of the Roman empire, however, individuals would undoubtedly form collections of coins peculiar to their own state; for Dr Stukely, in his Medallic History of Carausius, informs us, that a complete series of silver coins was lately found in Britain, containing all the emperors down to Carausius inclusively. From Banduri we also know, that certain Greek coins were specially preserved by the Romans; and it appears from their code, that ancient gold and silver coins were made use of instead of gems; to which distinction those of Sicily were particularly intitled. From the decline of the Roman empire till towards the end of the 5th century,

History. ry, almost all branches of literature were involved in darkness, and the medallic science among the rest. While the Christian dominion of Constantinople lasted, indeed, almost all the arts and sciences may be said to have been kept within its own boundaries; though the Arabs and eastern nations had some arts and sciences of their own: but after the destruction of the imperial city by the Turks, the Greeks were once more compelled to become fathers to the European Science. Even before this time, indeed, some vestiges of a revival of literature had appeared in Italy; "and so intimate and necessary a connection (says Mr Pinkerton) has now the study of medals with that of ancient erudition, that on the the earliest appearance of a revival of the latter, the former was also disclosed."

14 Collectors of medals. The first among the moderns who began to study the medallic science was Petrarch. Being desired by the Emperor Charles IV. to compose a book containing the lives of eminent men, and to place him in the list, he replied, that he would do so whenever the emperor's life and conduct deserved it. In consequence of this conversation be afterwards sent the emperor a collection of gold and silver coins bearing the representations of eminent men, with an address suitable to his former declaration. A collection of coins was made in the next age by Alphonso king of Arragon; but though this monarch collected all that could be found throughout Italy, we know that there could not have been very many, as the whole were contained in an ivory cabinet, and carried always about with him. A very considerable collection was made by Anthony Cardinal St Mark, nephew to Eugene IV. who ascended the pontifical chair in 1431; and soon after the grand museum at Florence was begun by Cosmo de Medici, where a collection of ancient coins and medals had a place among other curiosities. Corvinus king of Hungary about the same time formed a noble collection of coins along with ancient manuscripts and other valuable relicts of antiquity.

Mr Pinkerton considers Agnolo Poliziano, more commonly known by the name of *Angelus Politianus* as the first writer who adduced medals as vouchers of ancient orthography and customs. He cites different coins of the Medicean collection in his Miscellanea written about the year 1490. By means of a cabinet of medals collected by Maximilian I. emperor of Germany, Joannes Huttichius was enabled to publish a book of the lives of the emperors, enriched with their portraits, delineated from ancient coins. It is generally supposed that this book, which appeared in 1525, was the first work of the kind; but Labbe, in his *Bibliotheca Nummaria*, mentions another named *Illustrium Imagines*, by one Andreas Fulvius, printed in 1517, in which most of the portraits seem to be from medals. About the year 1512 also, Guillaume Bude, a French author, had written his treatise *De Asse*, though it was not printed till many years afterwards. M. Grollier, treasurer of the French armies in Italy, during part of the 16th century, had a great collection of coins of different kinds of metals. After his death, his brass medals were sent to Provence, and were about to be sent into Italy; when the king of France, having got information of the transaction, gave orders to stop them, and purchase the whole at a very high price for his own cabinet of antiquities. M. Grollier had an assortment of gold and silver as well as of brass medals: the cabinet in which they were contained, fell two centuries afterwards into the hands of M. L'Abbe de Bothelin; and was known to have been that of Grollier from some slips of paper, on which was his usual inscription for his books, *Joannis Grollierii, et amicorum.*

15 Number of cabinets. Cotemporary with Grollier was Guillaume de Choul, who was likewise a man of rank and fortune. He had a good collection of medals, and published many in his Treatise on the Religion of the ancient Romans in 1557. In the low countries we know, from the letters of Erasmus, that the study of medals was begun about the beginning of the 16th century. About the middle of that century, Hubertzus Goltzius, a printer and engraver, travelled over most countries in Europe searching for coins and medals, in order to publish books concerning them. From one of these works it appears, that there were then in the low countries 200 cabinets of medals; 175 in Germany, upwards of 380 in Italy, and 200 in France. It is probable, however, that there are now four times as many in these countries, besides 500 in Britain; but we are not to imagine that all these were grand collections, for of such there are not above a dozen even in Italy: most of those just mentioned were of the class named *caskets* of medals, containing from 100 to 1000 or 2000.

16. Number of coins found in Britain. There are few countries, Italy excepted, in which a greater number of coins have been found than in Britain; though we are by no means well acquainted with the time when the study of them commenced. Mr Pinkerton suspects that Cambden was one of the first, if not the very first, British author who produced medals in his works, and who must have had a small collection. Speed's Chronicle, published in the 17th century, was illustrated with coins from Sir Robert Cotton's cabinet. Gorlæus's collection was purchased by Henry prince of Wales, brother to Charles I. to whom he left it at his death. According to Joseph Scaliger, it consisted of 30,000 coins and medals. A collection 5500 coins was purchased by Archbishop Laud for L.600, and given to the Bodleian library. Thomas earl of Arundel, earl-marshall of England, well known from the Arundelian tables and other antiquities which he imported from Greece and Italy into Britain, had a rich cabinet of medals collected by Daniel Nisum. The dukes of Buckingham and Hamilton, Sir William Paston, Sir Thomas Fanshaw of Ware-Park, Sir Thomas Hanmer, Ralph Sheldon, Esq; Mr Selden, &c. are enumerated by Evelyn as collectors of medals. Charles I. as well as his historian the earl of Clarendon, were also collectors. The king had a very fine cabinet; which, however, were dissipated and lost during the civil commotions. Oliver Cromwell had a small collection; and the cabinet of Charles II. is mentioned by Vaillant in the preface to his treatise intitled *Numini in Coloniis*," &c. This branch of magnificence has not been much attended to by succeeding British monarchs; though his present majesty has a very good collection of ancient gold coins.

17 British cabinets. A great number of fine cabinets have been formed in Britain since the time of Evelyn. About the year 1720 Haym makes mention of those of the duke of Devonshire, the earls of Pembroke and Winchelsea, Sir

Of what constructed

Sir Hans Sloane, Sir Andrew Fontaine, Mr Sadler, Mr Abdy, Mr Wren, Mr Chicheley, and Mr Kemp. At present there are many remarkable collections; but that of the late Dr Hunter is deservedly esteemed the most remarkable in Europe, excepting that of the French king. It was not only formed at a great expence, but with much care and ability; many foreign medals offered to it having been rejected. The other remarkable collections are those of the duke of Devonshire, the earl of Pembroke, earl Fitzwilliam, formerly the marquis of Rockingham's, the honourable Horace Walpole, the reverend Mr Cruchrode, the reverend Mr Southgate, Mr Townley, Mr R. P. Knight, Mr Edward, Knight, Mr Tyson, Mr Barker, Mr Brown, and several others. The museum and universities have also collections; as well as the lawyers library, and the colleges in Scotland.

Sect. IV. *Materials of which Medals are constructed.*

18 Ancient gold coins.

Medals are formed of gold, silver, and the various modifications of copper. The gold usually made use of in coinage is about the fineness of 22 carats; and as the art of purifying this metal was very much unknown in former times, the most ancient medals are for this reason much more impure than the modern coins. Gold is never found in its native state above 22 carats fine; and the very ancient medals are much under that standard. Many of them are composed of a mixture of gold and silver, called by the ancients *electrum*. The gold medals were made of much finer metal after Philip of Macedon became possessed of the gold mines of Philippi in Thrace, and the medals of his son Alexander the Great are equally fine; as well as those of some other princes of that age. Those of the Egyptian Ptolemies are of the fineness of 23 carats three grains, with only one grain of alloy. The Roman coins are very pure even from the earliest times; the art of refining gold being well known before any was coined at Rome. Some authors are of opinion, that the Roman coins begin to fall short of their purity after the time of Titus; but Mr Pinkerton denies that any thing of this kind takes place till the time of the Emperor Severus; and even then only in a very few instances. Most of the Roman gold was brought from Dalmatia and Dacia, where that metal is still to be met with. A very remarkable circumstance is observed in the eastern part of Hungary, which belonged to the ancient Dacia: It germinates in the vines of Tokay, and is found in their stems; as it is elsewhere in the straw of corn.

19 Metal called *electrum*.

Pliny informs us, and indeed it is generally known, that gold and silver are found mixed together in the earth. When the silver amounted to one-fifth part of the gold, the metal was called *electrum*; but sometimes the quantity of silver was added artificially. The gold was in those days as well as at present refined by means of mercury: and the ancient artists had certainly attained to great perfection in this branch of metallurgy; as Bodin tells us, that the goldsmiths of Paris upon melting one of Vespasian's gold coins found only $\frac{1}{788}$ part of alloy.

20 Ancient silver.

Most of the ancient silver, particularly that of Greece, is less pure than that of succeeding times; even the Roman silver is rather inferior to the present standard, and that from the very beginning; but in the time of Severus, the silver appears very bad, and continues so until the time of Diocleſian. Many writers upon this subject have mistaken the *denarii ærei*, "coins of brass washed with silver," for silver currency. Silver coins are extremely scarce from the time of Claudius Gothicus to that of Diocleſian, or from the year 270 to 284; in which short space no fewer than eight emperors reigned. Silver at that time was found mostly in Spain and the commerce with that country was disturbed by the usurpers who arose in Gaul: and such were the troubles of the times, that not only the silver, but also the gold coins of those eight emperors, are extremely scarce. There is still, however, some silver extant of these eight emperors; and it is certain, that copper washed was never used as silver currency, but was entirely a distinct coinage. Occasional depravations of silver had taken place long before; as Pliny tells us, that Mark Anthony mixed iron with his silver denarii; and Mr Pinkerton informs us, that he had seeen a denarius of Anthony, which was attracted by a magnet.

21 Ancient brass.

The ancient brass coins consist of two kinds: the red or Cyprian, which indeed is no other than copper; and the common yellow brass. Our author observes, that in the Roman coinage brass was of double the value of copper, and he is of opinion, that it was the same among the Greeks; and the latter is the metal most commonly made use of in the Greek coinage. The Roman sestertii are always of brass: the middling-sized kind are partly copper and partly brass; the former being double the value of the latter, which are the *ases*.

22 Mixed metals.

Mr Pinkerton next proceeds to give an account of the mixed metals used among the Romans. In Britain all kinds of coins made of mixed metal are without hesitation alleged to be forgeries; although it is certain that the variety of mixed metals used in coinage was very considerable. The most valuable mixture was that of gold or silver already mentioned, named *electrum*; the silver commonly amounting to one-fifth part of the gold made use of, or perhaps more. Of this mixture are many of the early coins of Lydia, and some other Asiatic states; also those of the kings of the Bosphorus Cimmerius, during the imperial ages of Rome. Next to the electrum were the coins of Corinthian brass: but Mr Pinkerton informs us, that not a single coin was ever struck of this metal by the ancients; it having been constantly employed only in the fabrication of vases or toys. It was in use at any rate only for a very short time; being altogether unknown in the days of Pliny the Elder. Our author therefore ridicules those who pretend not only to find out imperial coins of this metal, but to discover three kinds of it; *viz.* one in which the gold predominates, another in which the silver prevails, and a third where the brass is most conspicuous. He gives Æneas Vico, one of the most ancient writers on medals, as the author of this idea; but whose opinions were confuted by one Savot, a writer in the 17th century. Vico mentions a coin of this kind struck under Augustus, another of Livia, and a third of Claudius. The mistake, he is of opinion, arose from the circumstance of the first propagator not being able to account for the various

23 Corinthian brass.

Of what constructed

various mixtures and modifications of brass observable in ancient coins of the large size; and which in so common a metal appear very odd to the moderns. Besides the authority of Pliny and other antiquaries of more modern date, who all declare that they never saw a single medal of Corinthian brass, or of that metal mixed with silver and gold, our author adduces another evidence which he looks upon to be superior to either; *viz.* that those who have given into this supposition, imagine, that the large pieces called *sestertii*, and others called *dupondiarii*, worth about twopence or a penny, are said to have been composed of this precious metal. It is unreasonable to think, that any proportion of gold or silver could have been made use of in these. The coins said to have been struck upon Corinthian brass are only done upon a modification of common brass; of which we know, that in proportion to the quantity of zinc made use of in conjunction with the copper, the metal assumes a variety of hues. On the authority of Pliny he informs us, that the coins mistaken for Corinthian brass were no other than prince's metal.

24 Egyptian silver coins

The Egyptian silver coins struck under the Roman emperors are at first of tolerably pure silver; but afterwards degenerate into a mixture of copper and tin with a little silver. They are very thick, but many of them are elegantly struck, with uncommon reverses. There are likewise three sets of brass coins belonging to this country from the earliest times of the Roman emperors there. Some of these are of bell-metal or pot-metal; and after the time of Gallienus and Valerian, the coinage of brass with a small addition of silver becomes authorised by the state; the coins struck upon it being called *denarii ærei*. Those of lead or copper plated with silver have been fabricated by Roman forgers. Some coins of lead, however, have been met with of undoubted antiquity; and an ancient writer informs us that tin-money was coined by Dionysius; but none has been found. The lead coins of Tigranes king of Armenia, mentioned as genuine by Jobert, and accounted forgeries by Mr Pinkerton and other modern medallists. Plautus, however, makes mention of leaden coins, and several of them have been found; but our author looks upon them to have been chiefly easy pieces, struck in order to let the artist judge of the progress of the dye. Others are the plated kind already mentioned, fabricated by ancient forgers, but having the plating worn off. A great number of leaden coins are mentioned by Ficorini in a work intitled *Piombi Antichi*, in which he supposed them to have served as tickets for guests; and coins of the same kind are also mentioned by Passeri. In the work intitled *Notitia Imperii Romani*, there is mention of coins made of leather, but none of them have ever been found.

Sect. V. *Of Ancient Money.*

In considering the different sizes, values, &c. of the Greek and Roman coins, our author treats of the medals as money; a knowledge of which, he says is essentially necessary to every reader of the classics; insomuch that it may almost dispute the preference with the studies of ancient geography and chronology. Notwithstanding all that has been written upon the subject, however, our author is of opinion, that the science is still in its infancy, in as far as it relates to the real money of the ancients. "The ideal (says he), which is indeed the most important province of discussion, has been pretty clearly ascertained; and we are almost as well acquainted with the Attic *mna* or *mina*, and the perplexing progress of the Roman *sestertia*, as with our own *pounds*. But with the actual coin of the ancients the case is different; and the ignorance even of the learned in this point is wonderful."

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25 Knowledge of ancient money imperfect.

Our author now goes on, with great asperity of language, to particularise the ignorant manner in which modern authors have treated the subject of medals. "Arbuthnot and Clarke (says he) are if possible more ignorant of medals than Budæus the very first. The latter professes his love of medals, but quotes a consular coin with the head of Cicero; and looks upon one of the 30 pieces of silver, the reward of the treachery of Judas, and which was said to be preserved among some relicts at Paris, to be worthy of reference and commemoration. Arbuthnot, if we may judge from his book, had never seen any ancient coins; and Clarke, it is well known, was quite ignorant of them. The latter, with all his labour, seems even to have known nothing of the theoretic part of the real ancient money. Indeed Dr Mead's catalogue seems to have been almost the only *book* on medals which had undergone his perusal. On the other hand, the ignorance of medallists on this score is no less profound. To this day they look upon the *didrachms* of Ægina, so celebrated in antiquity, as *tridrachms* of Ægium; and upon the early obolus as a brass coin. In the Roman class the large brass is esteemed the *as*, while it shall be proved that it is the *sestertius*, and worth four *asses*. The *denarius* is reckoned at ten ases even in the imperial times; whereas it only went at that rate for the first 90 years after the coinage of silver at Rome. The denarius æreus is taken for silver currency; with other mistakes which evince that medallists are as ignorant of the theory as the others are of the practice."

26 Money first coined in the east.

In his account of the ancient Greek money, Mr Pinkerton observes, that the light of science, like that of the sun, has proceeded from east to west. "It is most probable (says he), that the first invention of money arose like the other arts and sciences; and spread from thence into the western parts of the world.

27 Its first rude state.

In its first shape it appeared as mere pieces of metal without any stated form or impression; in lieu of which, it was regulated by weight. Even down to the Saxon government in England, large sums were regulated by weight; and in our own times every single piece is weighed in gold; though with regard to silver this nicety is not minded, nor indeed does it seem practicable. Among the ancients, whose commercial transactions were less important and extensive than those of the moderns, silver was weighed as well as gold; nay even brass, in some cases.

28 Greek money.

In Greece, large sums were determined by *mnæ* or *minæ*; and the most capital sums by *talents*. In every country the mina is supposed to have contained 100 drachmæ or small silver coins, of that country, and the talent 60 minæ. The mina is supposed to be a pound weight of the country to which it belonged. The Attic pound, according to Dr Arbuthnot contained

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tained 16 ounces, equal to our avoirdupois pound: but Mr Pinkerton looks upon this as a very absurd opinion, and accuses the Doctor of having adopted it merely that he may explain a passage in Livy. He is of opinion, that the Attic pound is very nearly the same with the pound Troy. The mina of Athens had at first 73 drachms; but by Solon it was fixed at 100. The ancient drachm weighed the same which it does at present in medical weight, *viz.* the eighth part of an ounce. The mina or pound of 12 ounces had consequently 96 of these drachms; but four of them were given to the round sum to supply defects in the alloy; "and indeed (says our author), in consequence of a common practice in all ages and in all countries, of giving some addition to a large weight. Thus the pound in weight had but 96 drachms in fact, while the pound in tale had 100; as the Roman libra in weight had but 84 denarii; in tale 100; and as our pound in tale, by an inverse progress, is not a third of our pound in common weight."

29 Of the ancient *talents*.

Notwithstanding the very severe criticism on Dr Arbuthnot just mentioned, however, we find our author adopting his account of the *talents* used in coinage in several countries. Thus, according to the Doctor,

The Syrian talent had		15 Attic minæ.
Ptolemaic	-	20
Antiochian	-	60
Eubœan	- -	60
Babylonian	-	70
Larger Attic	-	80
Tyrian	- -	80
Egyptian	-	80
Eginean	-	100
Rhodian	-	100

Notwithstanding the concession made here by Mr Pinkerton to the Doctor, he tells us, that he very much questions this list of talents, and that many ancient writers are little to be relied upon. "Writers on this subject confess, that the numbers in all ancient manuscrips are the parts most subject to error, as being almost always contracted. They ought to allow that the authors themselves must often be liable to wrong information.

"Herodotus mentions, that King Darius ordered gold to be paid into his treasury by the Euboic talent, and silver by the Babylonian. The Euboic is esteemed the same with that called afterwards the Attic: and as we estimate gold by carats, so it is natural to suppose, that the most precious metal would be regulated by the most minute weight. But I confess, I take the Babylonic talent to be the same with that of Ægina. Mr Raper has proved the first coins of Macedon to be upon the standard of Ægina. Now the early Persian coins are upon that very scale, the largest tetradrachms weighing from 430 to 440 grains. Hence it follows, that the Persian silver coins were of the Æginian standard; and the payment was certainly to be made according to the standard of the money. The larger Attic talent was of 80 lesser minæ; because the larger Attic mina was of 16 ounces. The Alexandrian talent, according to Festus, consisted of 12,000 denarii, being the same with that used by the Egyptian kings in their coins; and is shown by Mr Raper to have been the same with the talent of Ægina. Perhaps the whole of the ancient coins of Asia, Africa, Greece, Magna Grecia, and Sicily, are reducible to three talents or standards. 1. That of Ægina, used in most of the more ancient silver coinages; as would seem in even the later Egypt, Carthage, Cyrene, &c. 2. The Attic (being the Asiatic gold standard, afterwards used by Phidon king of Argos in estimating gold, and called Euboic from Eubœa, one of the quarters of the city of Argos), used in Athens and the greater part of the world as the standard both of gold and silver. 3. The Doric or Sicilian talent of 24 nummi, each worth an obolus and an half; whence the talent is estimated at six Attic drachms or three darics. These weights continued to be the standard of money after it began to be distinguished by impression; nay, to the fall of Greece and prevalence of the Roman empire."

30 Coinage originates in Lydia.

Coinage, according to Herodotus, was first invented by the Lydians, from whom the Greeks quickly received it. The former could not have received it from the Persians, whose empire did not begin till 570 B. C. though our author supposes that it might have proceeded from the Syrians, who carried on commerce in very ancient times. The most ancient Greek coins of silver have an indented mark upon one side, and a tortoise upon the other; and those of greatest antiquity have no letters upon them. Those of later date have ΑΙΓΙ marked upon them, which medallists interpret of Ægium in Achaia; being led into that supposition by the tortoise, which they look upon as the sure mark of the Peloponnesus. But though our author agrees that the tortoise was so, he thinks that they are otherwise very far wrong in their conclusions. Ægium in Achaia was a place of no consequence till the times of Aratus and the Achaian league; but there are 11 of these coins in Dr Hunter's cabinet, which show that they must have been struck in times of the most remote antiquity, and that the place where they were struck was rich and flourishing at the time. The coins we speak of are not uncommon; but those which have the name ΑΙΓΕΙΩΝ at full length, and which may perhaps belong to Ægium in Achaia, are extremely scarce; insomuch that in all Dr Hunter's vast collection there are not above one or two. They are likewise constructed upon a scale quite different from all other Grecian money; being of 8, 13, 15½, 90, and about 186 grains: The Grecian drachma at an average is 66 grains; Mr Pinkerton thinks it would have been strange if pieces had been struck of eight-tenths of an obolus, of an obolus and an half, or of a drachma and an half. Ægium being originally an obscure village, could not be the first which coined money; so that Mr Pinkerton supposes the name ΑΙΓΙ to have stood for Ægialus, the ancient name of Sicyon, a wealthy and powerful city; or rather Ægina, the mint of which was much celebrated, and perhaps the most ancient in Greece.

31 Most ancient Greek coins described.

Other arguments in favour of these coins being derived from Ægina, are drawn from their weight as well as their workmanship, which are quite different from those bearing the name of Ægium at full length. The coinage of Ægina is known to have been different from that of the rest of Greece; insomuch that its drachm was worth 10 Attic oboli, while the Attic drachm was valued only at six. Hence the drach-

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mas of Ægina were named by the Greeks πακειαν, or *thick*; a name very applicable to the coins in question. From these observations, our author is of opinion, that we may even distinguish the precise weight of the ancient coins of Ægina. According to the exact proportion, the drachma of this place should weigh exactly 110 grains; and one of them very much rubbed weighed above 90. The others of larger size, which seem to be didrachms of Ægina, weigh from 181 to 194 grains; but the latter being the only one he could meet with in good preservation, it was impossible to form any just medium. Even in those best preserved, he thinks that ten grains may be allowed for a waste of the metal in so long a time as 2400 years, which would bring the drachma of Ægina near its proper standard. The obolus of Ægina was in proportion to its drachma of six oboli. It is the piece of $15\frac{1}{2}$ grains, and 13 when very much rubbed. The hemiobolon is that of eight, and when rubbed ought to weigh seven.

32 The drachma the most general denomination.

The general denomination of the Greek money is the drachma, or eighth part of an ounce; which to this day is retained in the medical weights, the Grecian coins receiving their names from the weights they bore; though in some instances the weights received their appellations from the coins. The silver drachma, according to Mr Pinkerton, was about nine pence sterling; and he finds fault with those who make the drachma and denarius both equal to one another, the latter being no more than eight pence. The didrachm of silver, according to the same calculation, was worth 18d.; but the *tridrachm* occurs very rarely; and Mr Pinkerton is even of opinion, that medallists give this name to the didrachm of Ægina. The largest of all the Grecian coins is the tetradrachm, which on the Æginean standard is worth five shillings; but in those of the other states only four. There are, however, many subdivisions in the silver drachma; the highest being the tetraobolion or coin of four oboli; being in proportion to the drachma as the groat to a sixpence, weighing about 44 grains, and being in value about sixpence. The hemidrachm or triobolion comes next in value, weighing about 33 grains, and worth fourpence halfpenny. The silver diobolion, or third of the drachma, weighs about 22 grains, and is worth three pence. The obolus of silver weighs about 11 grains, and is worth only three halfpence. There is likewise a hemiobolion in silver, or half the obolus, of five grains and an half, value three farthings; and another called *tetartobolion dichalcos* or quarter obolus, which is the most minute coin yet met with; and by reason of its extreme smallness, weighing only two grains and a quarter, is now very scarce: but there is one in the cabinet of Dr Hunter, and some more have been lately brought from Athens by Mr Stuart. Some of them are likewise met with at Tarentum. It would appear, however, that there were some still smaller, and of value only three-fourths of a farthing. None of these have been met with; and the smallness of the size renders it improbable that any will ever be met with; as the peasants, who commonly discover coins, would probably either not observe them at all, or if they did would neglect them as things of no value.

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33 Different names of Greek coins.

Many different names have been imposed on the coins belonging to the different states of Greece: thus Κορη, *the maiden*, was a name often applied to the tetradrachm, and which would seem to apply to those of Athens; though there are coins of other cities with the head of Proserpine, and the word Κορη, to which it would appear more applicable in our author's opinion. Χελωνε, *the shell*, was the name of another coin from its type. A Sicilian coin was named Δεμαρετιον, from Gelon's wife. A tetradrachm was named Κρατατατγους, and had eight ευθειας or hemidrachms. The τροιζηνιον, so called from its country Troizene, had Pallas on one side and a trident on the reverse. The hemiobolion was the πελανος of Lacedemon; and the Κολλυβος is supposed to have been equal to the Roman sestertius or quarter drachma. The *cystophori* were coins with the mystic chest or hamper of Bachus upon them, out of which a serpent rises; and are much celebrated in antiquity. We are told by Livy, that Marcus Acilius, in his triumph over Antiochus and the Etolians, carried 248,000 of them; Cneius Manlius Vulso in that over Gallo-Græcia had 250,000; and Lucius Emilius Regillus, in his naval triumph over the fleets of Antiochus, had 131,300. Cicero likewise mentions his being possessed of a vast sum in them. The most probable opinion concerning them seems to be, that they are all silver tetradrachms; such as belong to the cities of Apamea and Laodicea in Phrygia; Pergamus in Mysia; Sardis and Tralles in Lydia; and Ephesus; but it is a mistake to ascribe any to Crete. Mr Pinkerton thinks it absurd to imagine that Crete a small island, should strike such vast numbers of coins; though Cicero mentions his being in possession of an immense treasure in them at the time he was governor of Asia Minor. "It is most likely (says Mr Pinkerton), that his wealth should be in the coin of the country to which he belonged. But what had these triumphs or Cicero's government, to do with Cretan money? But indeed the coins themselves, as above noticed, establish the fact."

34 Coins of Cyzicus.

Another set of coins famous in antiquity were those of Cyzicus in Mysia, which were of gold; but they are now almost entirely vanished by being recoined in other forms. The Αριανδικον νομισμα, or *money of Aryandes*, who was made governor of Egypt by Cambyses, is made mention of by Hysychius; but none of them, as far as is known, have reached our times. They must have been marked with Persian characters, if with any. The coin of Queen *Philistis* is mentioned by the same writer, and many of these pieces are still extant; but we know not where this queen reigned, nor does there seem to be any method of finding it out. Mr Pinkerton inclines to believe, that she presided over Sicily; and as a confirmation of that supposition, mentions some inscriptions of ΒΑΣΙΛΙΣΣΑΣ ΦΙΛΙΣΤΙΔΟΣ on the *Gradini* of the theatre at Syracuse; but which appear not older than the Roman times. Some authors are of opinion, that she reigned in Cossara or Malta; which our author thinks much more improbable.

35 Athenian coins.

The most particular attention with regard to the name and standard to coins is due those of Athens; and it is remarkable, that most of them which have reached us are of a very late period, with the names of

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magistrates inscribed upon them. Some of these bear the name of Mithridates; and few are older than the era of that prince; who, it is well known, took the city of Athens in his war with the Romans. I suspect (says Mr Pinkerton) that no Athenian coins of silver are posterior to Sylla's infamous destruction of that city: an event the more remarkable, as Sallust tells us, that Sylla was learned in Greek. Indeed Caligula, Nero, and most of the pests of society, have been learned men, in spite of a noted axiom of Ovid,

Sed ingenuas didicisse feliciter artes
Emollit mores, nec sinit esse feros.

It is still more remarkable, that the fabric of Athenian coins is almost universally very rude: a singular circumstance, if we reflect how much the arts flourished there. It can only be accounted for from the excellence of their artists being such as to occasion all the good ones to be called into other countries, and none but the bad left at home. In like manner, the coins struck at Rome in the imperial times are excellent, as being done by the best Greek artists; while those of Greece, though famous at that time for producing miraculous artists, are during that period commonly of very mean execution. The opulence of Athens in her days of glory was very great; owing in an eminent degree to her rich commerce with the kingdoms on the Euxine sea; carried on chiefly from Delos, which belonged to Athens, and was the grand centre of that trade." Hence it has become matter of surprise to Neumann, that when there are so many coins of Mycene, an island even proverbially poor, there should be none of Delos. But Mr Pinkerton accounts for this from Mycene's being a free state, and Delos subject to Athens. "It may be well supposed (says he), that Athens had a mint at Delos; and such Athenian coins as have symbols of Apollo, Diana, or Latona, were struck in this island."

36 Greek copper money.

The copper money of the Greeks is next in antiquity to the silver. Mr Pinkerton is of opinion, that it was not used at Athens till the 26th year of the Peloponnesian war; about 404 years before Christ, and 300 after silver was first coined there. The first copper coins were those of Gelo of Syracuse, about 490 B. C.

37 Of the chalcos.

The chalcos of brass, of which eight went to the silver obolus, seems to have been the first kind of Greek coin. At first it was looked upon of so little consequence, that it became proverbial; and to say that a thing was not worth a *chalcos*, was equivalent to saying that it was worth nothing. As the Greeks became poor, however, even this diminutive coin was subdivided into two, four, nay eight λεπτα or small coins; but our author censures very severely those who have given an account of those divisions. "Pollux and Suidas, copying from him (says he), tells us, that there were seven lepta to one chalcos; a number the most unlikely that can be, from indivisibility and incapacity of proportion.

"Pollux lived in the time of Commodus, so was too late to be of the smallest authority: Suidas is four or five centuries later, and out of the question. Pliny tells us, that there were ten chalci to the obolus; Diodorus and Cleopatra that there were six; Isidorus says there were four; and if such writers differ about the larger denomination, we may well imagine that the smaller equally varied in different states; an idea supported by these undeniable witnesses the coins which remain. Most of the Greek copper-coin which has reached our times consists of Chalci; the lepta being so small as to be much more liable to be lost." In Dr Hunter's cabinet, however, there are several of the dilepta of Athens; and from being stamped with the representation of two owls, seem to be the same with the silver diobolus: "a circumstance (says Mr Pinkerton) of itself sufficient to confute Pollux; for a dilepton can form no part of seven; a number indeed which never appeared in any coinage of the same metals, and is contradictory to common sense. It may be observed, that the whole brass coins of Athens published by Dr Combe are reducible to four sizes, which may be the *lepton*, *dilepton*, *tetralepton* or *hemichalcos*, and *chalcos*. The first is not above the size of one of king James I.'s farthing tokens; the last about that of our common farthing." The *lepta* was also called Κερμα, as being change for the poor. The Κιδαβος, perhaps so called from the figure of a wolf upon it, was the coin of a particular state, and if of brass must have weighed three chalci. The other names of the copper-coins of Greece are but little known. Lycurgus ordered iron money to be coined at Sparta; but so perishable is this metal, that none of that kind of money has reached our times.

38 Lepton, dilepton, &c.

After the conquest of Greece by the Romans, most of the coins of that country diminished very much in their value, the gold coinage being totally discontinued; though some of the barbarous kings who used the Greek character were permitted to coin gold, but they used the Roman model; and the standard used by the few cities in Asia who spoke the Greek language in the times of the emperors is entirely unknown. Copper seems to have been the only metal coined at that time by the Greeks themselves; and that upon the Roman standard, then universal through the empire, that there might be no impediment to the circulation of currency. They retained, however, some of their own terms, using them along with those of the Romans. The *assarion* or *assarium* of Rome, the name of the diminished *as*, being 16 to the drachma or denarius, the obolus was so much diminished in value as to be struck in brass not much larger than the old chalcus, and valued at between two and three assaria; which was indeed its ancient rate as to the drachma. This appears from the copper coins of Chios, which have their names marked upon them. The brass obolus, at first equal in size to the Roman sestertius or large brass, lessens by degrees to about the size of a silver drachma. From the badness of the imperial coinage in Greece also, it appears that brass was very scarce in that country, as well as in all the cities using the Greek characters; being found mostly in the western countries of the Roman empire. The time of this declension in size of the Greek coins is by Mr Pinkerton supposed to have been from Augustus down to Gallienus. He is of opinion, however, that the copper obolus, at first above the size of large brass, was used in Greece about the time of its first subjection to Rome; and that the lepta ceasing, the chalci came in their room, with the dichalcus and the hemiobolion of brass.

39 Era of the declension of the Greek coinage.

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40 Gold coins of Greece.

With respect to the gold coins of the Greeks, Mr Pinkerton is of opinion that none of that metal was coined before the time of Philip or Macedon, as none have reached our times prior to the reign of that monarch. From a passage in Thucydides our author concludes, that in the beginning of the Peloponnesian war the Athenians had no gold coin. Mentioning the treasure in the Acripolis or citadel of Athens, at the commencement of that war. the historian mentions silver coin, and gold and silver in bullion: and had any of the gold been in coin, he would certainly have mentioned it. Philip began his reign about 68 years after the beginning of the Peloponnesian war; and we can scarce suppose that any city would have preceded the elegant and wealthy Athens in the coining of gold.

41 Gold coined early in Sicily.

Notwithstanding, however, this deficiency of gold coin among the Greeks, it is certain that the coinage of gold had taken place in Sicily long before; as we have gold coins of Gelo about 491 B. C. of Hiero I. 478, and of Dionysius I. in 404, all using the Greek characters; though not to be ranked among the gold coins of Greece, as Philip caused his to be. Gold coins of Syracuse even appear of the third class of antiquity, or with an indented square, and a small figure in one of its segments. Gold coins were used in the cities of Brettium, Tarentum, and throughout Magna Grecia; also in Panticapæa in Thrace, and likewise Cosa in that country; but not in Tuscany, as is commonly believed, though Neumann proves that they are struck by Brutus, and are unquestionably as ancient as the Greek coins. The Thebans and Athenians probably coined the first gold after Philip had set them the example, and when they were attempting to resist the projects of that enterprising monarch. The Ætolians probably coined their gold during the time of their greatest power about a century after Philip, and when they were combating the power of Aratus and the Achæan league. "There is (says Mr Pinkerton) but one ημιχρυσον of Thebes, much worn, in Dr Hunter's cabinet, and weighing but 59 grains; and perhaps not above two or three χρυσοι or gold didrachms of Athens in the world; one of which is also in the collection of Dr Hunter, and weighs 132½ grains. It appears to be more modern than the reign of Philip. That monarch having got possession of the mines of Philippi in Thrace, improved them so much, that they produced him annually above a thousand talents of gold, or 2,880,000l. of Sterling money. From this gold the first coins named from the monarch *Philippi* were struck. They were marked with his portrait; and for many ages after were so numerous, that they were common in the Roman empire: whence the name *Philippi* became at length common to gold, silver, and at last even brass coins of their size. Even in the time of Philip gold was very scarce in Greece; but after the Phocians had plundered the temple of Delphos, this precious metal, which had been valued as gems, and consecrated only to the decoration of the temples of the gods, began to be known among the Greeks. The comparative value of gold and silver, however, seem to have been at that time very different from what they are now. Herodotus values gold at 13 times its weight in silver; Plato in his Hipparchus at 12; and even the low value of 10 to 1. seems to have been the stated value in Greece, tho' in Rome the plenty of silver from the Spanish mines made the value of gold to be much higher; and there is no reason to think that it was ever valued in that city at less than 12 times its weight in silver. The *Philippus*, χρυσος, gold piece, or *stater*, is a didrachm, and is the most common of all the ancient coins. Mr Pinkerton is of opinion that it went for 20 silver drachms on its first appearance; but in latter times for 25 Greek drachmæ or Roman denarii. There are proofs of the Philippi being didrachms, both from the writings of ancient authors and from numbers of the coins themselves, which remain to this day; and that the χρυσος, or principal gold coin of Greece, was of the same weight, is also evident from ancient writings. It was anciently worth about 15s. but valuing gold now at the medium price of 4l. per ounce, it is worth about 20s. The ημιχρυσον, or half the former coin, scarcely occurs of the coinage of Philip and Alexander, though it does of Hiero I. of Syracuse and of king Pyrrhus. It passed for ten silver drachmas, and was valued only at 7s. 6. though now worth 10s. There was another division of this kind worth about 5 s. There were besides some lesser divisions of gold coins, which could not be worth above two drachmas. These were coined in Cyrene; and there were besides several old gold coins of Asia Minor, the value of which is now unknown. Our author supposes that they were coined not with relation to their weight as parts of the drachma, but merely to make them correspond with so many silver pieces as was necessary. There are also larger coins than the χρυσος, the διχρυσος of Alexander and Lysimachus being double its value. Some others are met with by Lysimachus, Antiochus III. and some of the Egyptian monarchs, weighing four times the χρυσος, and now worth about 4 l. sterling. Some weigh even more: but this our author supposes owing to the gold being less pure.

42 Roman money.

In Rome, as well as in Greece, the money was at first estimated by weight; and the first metal coined by that people was copper, silver being long unknown in Rome; nor is it certainly known that any silver has ever been found in the Italian mines. In Rome the first valuation of money was by the *libra gravis æris*, or pound of heavy brass: and in the progress of their conquests, the little silver and gold that came in their way was regulated by the same standard, as appears from the story of Brennus. The weights made use of were the same with those which continue to this day. The pound consisted of 12 ounces of 458 grains each; but the pound by which the money was weighed appears to have consisted only of 420 grains to the ounce, or to have contained in all 5040 grains. This became the standard of copper; and when silver came to be coined, seven denarii went to the ounce as eight drachms did in Greece. Gold was regulated by the *scriptulum* or *scrupulum*, the third part of a denarius, and by the larger weights just mentioned. The number 10 was at first used by the Romans in counting their money; but finding afterwards that a smaller number was more convenient, they divided it into quarters; and as the quarter of 10 is 2½, they for this reason bestowed upon it the name of *sestertius* or "half the third;" to express that it was two of any weights, measures, &c. and half a third; whence the sestertius came

43 Of the Roman pound

44 Sestertius, as, &c.

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came at last to be the grand estimate of Roman money. The *as* being at first the largest, and indeed the only Roman coin, the word *sestertius* means *sestertius as*, or "two ases and an half." On the first coining of silver, the denarius of ten ases was struck in the most common and convenient denary division of money, or that by tens; the sestertius being of course two ases and an half. But the denarius being afterwards estimated at 16 ases, the name sestertius was still applied to a quarter of the denarius, though it now contained four ases. The term *sestertius* was applied to all sums not exceeding 1000 sestertii, or L. 8 : 6 : 8; but for greater sums the mode of the sestertius was likewise altered, though not to exclude the former. Very large sums of money were estimated by the hundred weight of brass; for the Romans were at first unacquainted with the talent. The hundred weight, by way of eminence, was distinguished by the name of *pondus*, and *sestertium pondus* became a phrase for two hundred weight and an half. Mr Pinkerton is of opinion, that we may value the *as libralis* of ancient Rome at about eight-pence English. Estimating the *as* therefore at a pound weight, the *sestertium pondus* was equal to 1000 *sestertii*, or L. 8 : 6 : 8; and by a coincidence which our author supposes to have been the effect of design, as soon as the silver coinage appeared, the *sestertium certum denariorum* was always equal to L. 8. 6s. 8d. also. The word *sestertium* itself, however, seems to have been unknown prior to the coinage of silver money at Rome: the *pondera gravis æris* being sufficient before that time for all the purposes of a state in which money was so scarce. But however this may be the *pondus* or hundred weight of brass was precisely worth 100 denarii, or a pound of silver. As the great sestertium was always valued at 1000 of the smaller, or L. 8 : 6 : 8, we never find one sestertium mentioned in authors, but two, three, or more: ten thousand of them being equal to L. 8,333,333 : 6 : 8.

45 Whence the Romans derived their coinage.

The states from which the Romans may be supposed first to have derived their coinage, were the Etruscans and the Greek colonies in Magna Grecia and Sicily. Joseph Scaliger, Gronovius, &c. contend that it was from the Sicilians that the Romans first derived their knowledge of money; but Mr Pinkerton argues that it was from the Etruscans. In confirmation of his opinion he appeals to the state of the Roman territory in the time of Servius Tullius, who is looked upon to have been the first who coined money at Rome. At that time the whole Roman dominion did not extend beyond ten miles round the city; and was entirely surrounded by the Etruscan and Latin states; Cuma being the next Greek colony to it that was of any consequence, and which was in the neighbourhood of Naples, at about the distance of 150 miles. Our author asks, Is it reasonable to think that the Romans received the use of money from the Etruscans and Latins who were their neighbours, or from the Greeks, who were at a distance, and at that time, as far as appears from their history, absolutely unknown to them? "If this argument (adds he) is strong with regard to the nearest Grecian colonies, what must it be with respect to Sicily, an island 300 miles distant from Rome, where it was not known, at that time, if a boat went by land or water?" Arguments, however, for this opinion, have been derived from the similarity betwixt the Sicilian and Roman coins; which Mr Pinkerton now proceeds to examine. The Greek pound in Sicily was called λιτρα, and consisted, like the Roman, of 12 ουγκιαι, or ounces; and Mr Pinkerton grants that the Roman *libra* was derived from the Greek λιτρα, but denies that the *as*, or libra, a coin, was from Sicilian model. The Sicilians had indeed a coin named λιτρα; but it was of silver, and of equal value to the Eginean standard, ten of which went to the Sicilian δεκαλιτρον. He differs from Gronovius, that the standard of Ægina was used at Corinth, and of course at Syracuse; as it appears from Aristotle, that the Sicilians had a talent or standard of their own. The Sicilian obolus or λιτρα contained also 12 ounces or *chalci*, so named at first because they weighed an ounce weight; but the ουγκιαι of Hiero weigh more than a troy ounce; and the brass coins of Agrigentum are marked with cyphers as far as six; the largest weighing only 186 grains, or about one third of the primitive ounce. Our author denies that even the Roman denarius took its rise from the Sicilian δεκαλιτρον, as many authors assert. Were this the case, it would have weighed 180 grains; whereas the Roman denarii are not above the third part of the quantity.

46 Origin of the Sicilian coins.

From all these considerations, our author is of opinion that the Sicilians borrowed the division of their λιτρα from the Etruscans, or possibly from the Romans themselves; which our author thinks is more probable than that the Romans had it from Sicily. The strongest argument, however, against the Roman coinage being borrowed from the Sicilian is, that though great numbers of Sicilian coins are to be found in the cabinets of medallists, yet none of them resemble the *as libralis* of the Romans in any degree. In most cabinets also there are Etruscan coins upon the exact scale of the *as libralis*, and several of its divisions; from whence Mr Pinkerton concludes, that "these, and these alone, must have afforded a pattern to the primitive Roman coinage." The Etruscans were a colony from Lydia, to which country Herodotus ascribes the first invention of coinage." Those colonists (says Mr Pinkerton), upon looking round their settlements, and finding that *no* silver was to be had, and *much less* gold," supplied the mercantile medium with copper to which the case of Sweden is very similar, which, as late as the last century had copper coins of such magnitude, that wheel-barrows were used to carry off a sum not very considerable.

47 Of the most ancient Roman coins.

Some coins are found which exceed the *as libralis* in weight; and these are supposed to be prior to the time of Servius Tullius. Some of them are met with of 34 and of 53 Roman ounces; having upon one side the figure of a bull rudely impressed, and upon the other the bones of a fish. They are most commonly found at Tudder, or Tudertum in Umbria; but they appear always broken at one end; so that Mr Pinkerton is of opinion that perhaps some might be struck of the decussis form, or weighing ten pounds. These pieces, in our author's opinion, make it evident, that the Romans derived their large brass coins from the Etruscans and the neighbouring states; they are all cast in moulds; and the greater part of them appear much more ancient than the Roman ases, even such as are of the greatest antiquity.

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Mr Pinkerton agrees with Sir Isaac Newton as to the time that Servius Tullius reigned in Rome, which he supposes to be about 460 B. C. His coinage seems to have been confined to the as, or piece of brass having the impression of Janus on the one side and the prow of a ship on the other, because Janus arrived in Italy by sea. Varro, however, informs us, that the very first coins of Tullius had the figure of a bull, or other cattle upon them, like the Etruscan coins, of which they were imitations. Those with the figure of Janus and the prow of a ship upon them may be supposed first to have appeared about 400 years B. C. but, in a short time, various subdivisions of the as were coined. The *semis* or half is commonly stamped with the head of Jupiter laureated; the *triens* or third, having four cyphers, as being originally of four ounces weight, has the head of Minerva; the *quadrans* or quarter, marked with three cyphers, has the head of Hercules wrapt in the lion's skin; the *sextans* or sixth, having only two cyphers, is marked with the head of Mercury with a cap and wings; while the *uncia* having only one cypher, is marked with the head of Rome. All these coins appear to have been cast in moulds, by a considerable number at a time: and in the British museum there are four of them all united together as taken out of the mould in which perhaps dozens were cast together. In process of time, however, the smaller divisions were struck instead of being cast; but the larger still continued to be cast until the as fell to two ounces. Even after this time it was still called *libra*, and accounted a pound of copper; though there were now larger denominations of it coined, such as the *bissas* or double as: *tressis* and *quadrussis* of three and four ases; nay as far as *decussis* or ten ases, marked X. Olivieri mentions one in his own cabinet weighing upwards of 25 ounces, and cast when the as was about three ounces weight. There is likewise in the Musæum Etruscum a decussis of 40 Roman ounces, cast when the as was at four ounces. There was likewise a curious decussis in the Jesuit's library at Rome, for which an English medallist offered 20 l.; but it was seized by the Pope along with every other thing belonging to the society.

48 Subdivisions of the as.

49 Larger denominations of it struck.

Mr Pinkerton contests the opinion of Pliny that the as continued of a pound weight till the end of the first Punic war. His opinion (he says) is confuted by the coins which still remain; and it appears probable to him that the as decreased gradually in weight; and, from one or two of the pieces which still exist, he seems to think that the decrease was slow, as from a pound to eleven ounces, then to ten, nine, &c.; but neither the as nor its parts were ever correctly sized. During the time of the second Punic war, when the Romans were sore pressed by Hannibal, the as was reduced to a single ounce. It is said to have taken place in the 215th year before our era, being about 36 years after the former change. This as libralis, with the face of Janus upon it, is the form most commonly met with previous to its being reduced to two ounces. Our author supposes that the as libralis continued for at least a century and an half after the coinage of Tullus, down to 300 B. C. about the year of Rome 452, between which and the 502d year of Rome a gradual diminution of the as to two ounces must have taken place. The following table of the dates of the Roman coinage is given by Mr Pinkerton.

50 Decrease of the as in weight.

The libralis, coined by Tullus with the figures of oxen, &c. about 167 years after the building of Rome, according to Sir Isaac Newton, or about the year before Christ. 460

As libralis with Janus and the prow of a ship	400
As of ten ounces - - -	300
Eight - - - -	290
Six - - - -	280
Four - - - -	270
Three - - -	260
Two, according to Pliny - -	250
One, according to the same author -	214

About 175 B. C. also, we are informed by Pliny, that the as was reduced to half an ounce by the Papyrian law, at which it continued till the time of Pliny himself, and long after.

After the Romans began to have an intercourse with Greece, a variety of elegant figures appear upon the parts of the as, though not on the as itself till after the time of Sylla. Towards the latter end of the republic also, *dupondii*, or double ases, were coined, together with the sestertii ærei, which came in place of the *quadrusses*, when the denarius began to be reckoned at 16 ases; probably at the time the latter was reduced to half an ounce. In some instances it is to be observed, that the Romans accommodated their coins to the country where their army was stationed; whence we have many coins marked as Roman, which have been coined in Magna Grecia and Sicily, and are evidently upon the Greek and not the Roman scale. In the latter part of the republican times, also, the types begin to vary; so that we have a brass coin supposed to be struck by Sextus Pompeius in Sicily, having upon it a double head of that warrior, representing a Janus. Mr Pinkerton supposes it to have been a dupondius; which indeed appears to be the case from the double head. This coin is of copper, and still weighs an ounce, notwithstanding its antiquity.

51 Coins on the Greek scale marked as Roman.

The largest imperial copper coin was the sestertius, a piece worth about two-pence Sterling money. Mr Pinkerton censures severely the opinion of other medallists, all of whom say that the sestertius was of silver. "In fact (says he), it would be as rational in any antiquary, a thousand years hence, to contend that the halfpenny and farthing are of silver, because they were so in the reign of Henry VIII." In confirmation of his own opinion, he quotes the following passage from Pliny: "The greatest glory of brass is now due to the Marian, called also that of Cordova. This, after the Livian, most absorbs the lapis calaminaris, and imitates the goodness of native orichalcum in our sestertii and dupondiarii, the ases being contented with their own copper." Gronovius confesses that he does not know what to make of this passage, and that it causes him hesitate in his opinion. The *Livian* mine mentioned here by Pliny, is supposed to have got its name from *Livia* the wife of Augustus; and it is probable that the pieces marked with her portrait, intitled JUSTITIA, SALUS, VIRTUS, &c. were dupondii from this very mine, the metal being exceedingly fine, and of the kind named *Corinthian brass* by the ancient medallists. "Perhaps, (says Mr Pinkerton) the mine received its name from this very cir-

52 Of the sestertius.

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circumstance of her coins being struck in the metal taken from it."

53 Coinage of yellow brass.

No change took place in the Roman coinage from the time that the as fell to half an ounce to the days of Pliny; but Mr Pinkerton observes, that before the time of Julius Cæsar yellow brass began to be used, and was always looked upon to be double the value of Cyprian or red copper. There are but few coins in large brass immediately before Julius Cæsar, or even belonging to that emperor; but from the time of Augustus downward, the large coins are all found of brass, and not one of them copper. The largest of what are called the middle size are all of yellow brass; and the next size, which is the as, and weighs half an ounce, is universally copper. What the ancients named *orichalcum*, or what we call *brass*, was always looked upon to be greatly superior in value to the æs cyprium. Procopius, speaking of a statue of Justinian, tells us, that brass inferior in colour to gold is almost equal in value to silver. The mines of native brass were very few in number, and were owing entirely to the singular combination of copper and lapis calaminaris in the bowels of the earth, which very seldom occurs, and the ancients were far from being well acquainted with the method of combining these two bodies artificially; so that yellow brass was always esteemed at double the value of copper: and hence, in the ancient coinages, the brass and copper pieces were kept as distinct as those of gold and silver.

Mr Pinkerton challenges to himself the discovery that the imperial sestertius was of brass; and is at considerable pains to bring proofs of it. Besides the testimony of Pliny, which of itself would be decisive, this is supported by the strongest collateral evidence of other authors. From a passage in Julius Africanus, who wrote the Ιατρικα, or *Treatise on Medicine*, it appears that the nummus, or sestertius, weighed an ounce, and of consequence that it could not be silver but brass; and all the large imperial Roman coins weigh an ounce. We know not the age in which Julius Africanus lived; but as he makes the denarius to contain 16 ases, he must have been before the age of Gallienus, when it had 60. Gronovius supposes him to have been the same mentioned by Eusebius. This author speaks of a Julius Africanus who lived in the time of Heliogabulus, and whom Mr Pinkerton supposes to have been the same with him abovementioned.

54 Diminution of the sestertius.

The sestertius underwent no change till the time of Alexander Severus, when it was diminished by one third of its weight. Trajanus Decius was the first who coined double sestertii, or quinarii, of brass; but from the time of Trebonianus Gallus to that of Gallienus, when the first brass ceases, the sestertius does not weigh above the third part of an ounce: the larger coins are accounted double sestertii; and after the time of Gallienus it totally vanishes. In the time of Valerian and Gallienus we find a new kind of coinage, mentioned by the name of *denarii æris*, or *Philippi ærei*. Two sizes of denarii began to be used in the time of Caracalla; the larger of six sestertii, or 24 assaria; the smaller of four sestertii, or 16 assaria as usual. In the time of Pupienus, the latter was reduced to such a small size as not to weigh more than 36 grains; though in Caracalla's time it weighed 56. After the time of Gordian III. the smaller coin fell into disuse, as breeding confusion. The larger denarius of six sestertii, though diminished at last to the size of the early denarius, still retained its value of six sestertii, or 24 assaria. The *Philippus æreus* came at length in place of the sestertius. It was also called *denarius*; from which we may learn not only their size, but that they were in value ten assaria as the first denarius. In the reign of Diocleſian, the place of the sestertius was supplied by the *follis*, that emperor having restored the silver coin to its purity, and likewise given this form to the copper; but it would seem that this restoration of the coinage only took place towards the end of his reign; whence we have but few of his silver coins, and still fewer of the *folles*, though the *denarii ærei* continued quite common down to the time of Constantine. The follis of Diocleſian seems to have weighed above half an ounce; and Mr Pinkerton is of opinion, that Diocleſian designed this coin to supply the place of the denarius æreus; which of course was worth ten assariæ, and six of them went to the silver denarius. From this time the assarium diminishes to the size of 30 grains; and soon after the follis appeared, the denarius æreus was entirely dropped, the former having gradually supplied its place. Some mints appear to have retained the use of the denarius longer than others; and in some the change was preceded, and gradually brought in by washing the follis with silver or tin, as the denarius had formerly been. Pieces of this kind occur in the times of Diocleſian, Maximian I. and II. and Constantius I.; that is, for about ten years after the follis made its appearance. Some countries, however, retained the denarius æreus; others the follis; and some had a medium betwixt the two, or the follis washed in imitation of the denarius.

55 New coinage introduced by Constantine I.

Towards the end of the reign of Constantine I. a new coinage was introduced throughout the whole empire. The follis coined by this prince was of half an ounce weight; 24 of them going to the milliarensis, or larger silver coin. The word *follis* signifies also a purse, in which sense we sometimes find it mentioned in the Byzantine history. The common follis of silver, when it occurs by itself, means a purse of 250 milliarenses, as the sestertium was 250 denarii; and by a law of Constantine I. every man paid to the state a follis or purse according to his income. The method of counting by purses continues in Turkey to this day.

56 Of the dupondius.

The *dupondius* was only half the value of the sestertius, or about one penny Sterling; and before the yellow brass appeared it seems to have been struck upon copper, and double the size of the as. There are some of this coin, struck in the time of Julius Cæsar, in yellow brass, weighing half an ounce, with a head of Venus Victrix upon one side; on the reverse, a female figure, with serpents at her feet: while others have a Victory on the reverse, with Q. Oppius Pr. After the time of Augustus, the dupondius was struck in yellow brass; which Pliny tells us was also the case in his time. The word dupondiarius seems to have been used by Pliny, and adopted, not to express that the coin was *dupondius*, but that it was of dupondiary value. Neither was the former word confined to signify double weight, but was used also for double length or measure, as in the instance of *dupondius pes*, or two feet, &c. In the imperial

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perial times, therefore, *dupondius* was used, not to signify a coin of double the weight of the as, but of double the value. It was one of the most common of the Roman coins; and seems to have been very common even in Constantinople. In the time of Justinian, it seems there was a custom of nicknaming young students of the law *dupondii*, against which the emperor made a law; but it is not known what gave rise to the name. The dupondius, though of the same size with the as, is commonly of finer workmanship, the metal being greatly superior in value. It continues to be of yellow brass, as well as the sestertius, to the time of Gallienus; but the as is always of copper.

57 Of the assarium.

The imperial as, or *assarium*, was worth only an halfpenny. At first it weighed half an ounce, and was always of copper till the time of Gallienus, when it was made of brass, and weighed only the eight part of an ounce. From the time of Gallienus to that of Diocleſian, it continued to diminish still more, the size being then twenty to an ounce. This was the same with the lepta, or smallest coins but the νουμια, which weighed only ten grains.

58 Parts of the as.

The parts of the as occur but seldom; which may, indeed, be well expected, considering the low value of it; though there still occur some of those called semis, triens, quadrans, sextans, and uncia, coined in the times of Nero and Domitian. There is no small brass from the time of Pertinax to that of Gallienus, excepting that of Trajanus Decius; but in the time of Gallienus it becomes extremely common; and the coins of small brass, as well as the larger, are always marked S. C. such as want it being universally accounted forgeries, and were plated with silver, though the plating be now worn off. The small pieces struck for slaves during the time of the saturnalia must also be distinguished from the parts of the as. The S. C. upon these most probably signifies *Saturni Consulto*, and were struck in ridicule of the true coins, as the slaves on that occasion had every privilege of irony.

59 Of the smallest Roman coins.

The sestertius diminishes from Pertinax to Gallienus so fast that no parts of the as are struck, itself being so small. Trajanus Decius, indeed, coined some small pieces, which went for the semis of the time. The small brass coins under Gallienus were called assaria, sixty of which went to the silver denarius. They are about the size of the denarius, and some of them occur of the coinage of Gallus and his family, of half that size, which appear to have been struck during the latter part of his reign, when the assarium was diminished to a still smaller size. It is probable, however, that some of these very small coins had been struck in all ages of the empire, in order to scatter among the people on solemn occasions. Mr Pinkerton is of opinion that they are the *missilia*, though most other medallists think that they were medallions. "But if so (says our author), they were certainly called *missilia a non mittendo;* for it would be odd if fine medallions were scattered among the mob. It is a common custom just now to strike counters to scatter among the populace on such occasions, while medals are given to peers of the kingdom; and we may very justly reason from analogy on this occasion."

60 Of the missilia.

The *assarion* or *lepton* of the Constantinopolitan empire was, as we have already observed, one of the smallest coins known in antiquity, weighing no more than 20 grains; and the *noumia* were the very smallest which have reached our times, being only one-half of the former. By reason of their extreme smallness, they are very scarce; but Mr Pinkerton informs us, that he has in his possession a fine one of Theodosius II. which has on it the emperor's head in profile. Theodosius P. F. AV.; on the reverse a wreath, having in the centre VOT. XX.: MULT. XXX.

61 Coins of the lower empire.

The principal coin of the lower empire was the follis, which was divided into an half and quarter, named δημοσιοφολεις and τεταρτον; the latter of which is shown by Du Cange to have been a small brass coin, as the other is supposed to have been by Mr Pinkerton.—Besides these, the follis was divided into 8 oboli, 16 assaria or lepta, and 32 noumia, though in common computation it contained 40 of these last. This coin, notwithstanding so many divisions, was of no more value than an halfpenny.

Mr Pinkerton controverts an opinion, common among medallists, that the largest brass coin or follis of the lower empire had 40 small coins, expressed by the letter M upon it; the next had 30, expressed by the letter Λ; the half by the letter K; and the quarter marked I, which contained only 10. Mr. Pinkerton informs us, that he has three coins of Anastasius, all marked M in large: one of them weighs more than half an ounce; the second 40 grains less; and the third of 160 grains, or one-third of an ounce; but the size is so very unequal, that the last, which is very thick, does not appear above half the size of the first. There are pieces of Justinian which weigh a whole ounce; but the size of copper was increased as the silver became scarcer; and the value of the coinage cannot be deduced from the weight of the coins, as it is plain that our own coinage is not of half the value with regard to the metal. A great number of medallions were struck by Constantius II. but there is no other copper larger than the half ounce, excepting that of Anastasius, when the follis began to be struck larger. All medallists allow the others to be medallions.

The metal employed in these very small coins, though at first of brass, was always a base and refuse kind; but copper is generally made use of in the parts of the as from the earliest times to the latest; and if brass be sometimes employed, it is never such as appears in the sestertii and dupondiarii, which is very fine and beautiful, but only the refuse. "Yellow brass of the right sort (says Mr Pinkerton) seems totally to have ceased in the Roman coinage with the sestertius, under Gallienus, though a few small coins of very bad metal appear under that hue as late as Julian II."

62 Roman silver.

Silver was coined in Rome only as late as the 485th year of the city, or 266 B. C. Varro indeed speaks of silver having been coined by Servius Tullius, and the libella having been once in silver; but Pliny's authority must be accounted of more weight than that of this author, as he mistakes the λιτρα of Sicily for Roman coins, having been current at Rome during the time of the first Punic war. Even Pliny, according to our author, very frequently mistakes with regard to matters much antecedent to his own time; and among

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among the moderns he criticises severely Erasmus and Hume. "Erasmus (says he), who had been in England for some time, talks of leaden money being used here. Not even a leaden token was struck in the reign of Henry VIII.; yet his authority has been followed with due deference to so great a name; for how could Erasmus, who must have seen the matter with his own eyes, assert a direct falsehood? To give a later instance in a writer of reputation, Mr Hume, in vol. vi. of his history, has these words, in treating of the reign of James I. "It appears that copper halfpence and farthings began to be coined in this reign. Tradesmen had commonly carried on their retail business by leaden tokens. The small silver penny was soon lost; and at this time was nowhere to be found." Copper halfpence and farthings were not struck till Charles II. 1672: there were small tokens for farthings struck in copper by James I. but not one for the halfpenny. The silver farthings had ceased with Edward VI. but the silver half-pence continued the sole coins till Charles II. It was by copper tokens that small business was carried on. The silver penny was much used till the end of the reign of George I.; and, so far from being nowhere to be found, is superabundant of every reign since that period, not excepting even the present reign of George III. From these instances the reader may judge how strangely writers of all ages blunder, when treating a subject of which they are entirely ignorant."

63 Denarii when first coined,

The first silver denarii coined at Rome, are supposed by our author to have been those which are impressed with the ROMA; and he inclines to account those the most ancient which have a double female head on the one side, and on the reverse Jupiter in a car, with Victory holding the reins, and the word ROMA indented in a rude and singular manner. The double female head seems to denote Rome, in imitation of the Janus then upon the as. There are 15 of these in the cabinet of Dr Hunter; one of the largest weighs 98½ grains: and the rest, which seem to be of greatest antiquity, are of various weights betwixt that and 84; the smaller and more modern weigh 58 or 59 grains; but Mr Pinkerton is of opinion, that the large ones are of the very first Roman coinage, and struck during that interval of time betwixt the coinage of the first silver denarius and the as of two ounces. He takes the indentation of the word ROMA to be a mark of great antiquity; such a mode being scarcely known any where else, except in Caulonia, Crotona, and other towns of Italy; all of them allowed to be struck at least 400 B. C. As these large coins are not double denarii, they must have been struck prior to the small ones; and Newmann has given an account of one of them recoined by Trajan, in which the indentation of ROMA is carefully preserved. The first denarius was in value 10 ases, when the as weighed three ounces; and allowing 90 grains at a medium for one of these large denarii, the proportion of copper to silver must have been as 1 to 160; but when the as fell to one ounce, the proportion was as 1 to 80: when it fell to half an ounce, so that 16 ases went to the denarius, the proportion was as 1 to 64, at which it remained. Copper with us, in coinage, is to silver as 1 to 40; but in actual value as 1 to 72.

At Rome the denarius was worth 8d.; the quinarius 4d.; and the sestertius, whether silver or brass, 2d. The denarius is the coin from which our penny is derived, and was the chief silver coin in Rome for 600 years. According to Celsus, seven denarii went to the Roman ounce, which in metals did not exceed 430 grains; but as all the denarii hitherto met with weigh at a medium only 60 grains, this would seem to make the Roman ounce only 420 grains; though perhaps this deficiency may be accounted for from the unavoidable waste of metal even in the best preserved of these coins. According to this proportion the Roman pound contained 84 denarii; but in tale there was a very considerable excess: for no fewer than 100 denarii went to the Roman pound. The Greek ounce appears to have been considerably larger than that of Rome, containing about 528 grains; yet notwithstanding this apparently great odds, the difference in the coins was so small, that the Greek money went current in Rome, and the Roman in Greece. The denarius at first went for 10 asses, and was marked X; it was afterwards raised to 16; which Mr Pinkerton supposes to have been about 175 B. C. Some are met with bearing the number XVI. nay, with every number up to CCCCLXXVI. These large numbers are supposed to have been mint-marks of some kind or other. After being raised to 16 ases, it continued at the same value till the time of Gallienus: so that till that time we are to look upon its constituent parts to be 16 ases or assaria, eight dupondii, four brass sestertii, and two silver quinarii. Under the emperor Severus, however, or his successor Caracalla, denarii were struck of two sizes, one of them a third heavier than the common; which we must of consequence suppose to haveborne a third more value. This large piece obtained the name of *argenteus*, and *argenteus Philippus*, or the "silver Philip;" the name of Philip having become common to almost every coin. The common denarii now began to be termed *minuti* and *argentei Philippi minutuli*, &c. to express their being smaller than the rest. Some have imagined that the large denarii were of the same value with the small, only of worse metal; but Mr Pinkerton observes, that among the few which have any difference of metal, the smallest are always the worst. The first mention of the *minuti* is in the time of Alexander Severus, who reduced the price of pork from eight minuti at Rome to two and to one. The *minutus argenteus* of that age was about 40 grains; and from the badness of the metal was not worth above 4d. of our money. Thus the price of meat was by this prince reduced first to 8d. and then to 4d.

[63] Value of the denarius and its parts,

64 Restoration of the purity of the Roman coins,

According to Zozimus and other writers, the purity of the Roman coin was restored by Aurelian: but Mr Pinkerton controverts this opinion; thinking it more probable, that he only made the attempt without success; or that his reformation might be entirely confined to gold, on which there is an evident change after the time of this emperor. His successor Tacitus is said to have allowed no brass to be mixed with silver upon any account; yet the few coins of this emperor are very much alloyed. We are certain, however, that the emperor Diocleſian restored the silver to its ancient purity; the denarii struck in his reign being very small indeed, but of as fine silver as the most ancient coins of the empire. After Gordian

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dian III. the ſmall denarius entirely vaniſhed, while the large one was ſo much diminiſhed, that it reſembled the *minutus*, or ſmall one of Carcalla in ſize. Gallienus introduced the *denarii ærei* inſtead of the *ſeſtertii*. The *argenteus*, though reduced more than one third in ſize, contained ſix denarii aerei, the old ſtandard of ſeſtertii. According to the writers of this period, and ſome time afterwards, the denarius or argenteus contained 60 aſſaria; whence it follows, that each denarius æreus had 10; and from this it probably had its name. The aſſaria are of the ſize of the argentei already mentioned; and ſhow the copper to have retained nearly its old proportion of value to the ſilver, viz. 1 to 60.

65 Reformation of the ſilver coin by Conſtantine.

A larger ſilver coin was introduced by Conſtantine I. who accommodated the new money to the pound of gold in ſuch a manner, that 1000 of the former in tale were equal to the latter in value; ſo that this new piece from thence obtained the name of the *milliarenſis* or "thouſander." Its weight at a medium is 70 grains, or 70 to the pound of ſilver: but Mr Pinkerton is of opinion, that it might have contained 72 grains, of which two have now periſhed by the ſoftneſs of the ſilver; that the pound contained 72; or that two of the number might be allowed for coinage; while the alloy alone would pay for coining gold. The code ſays, that 60 went to the pound; but the numbers of this are quite corrupt. The *milliarenſis* was worth about a ſhilling ſterling. The argentei or denarii, however, were ſtill the moſt common currency; and having been originally rated at the 100 to the pound of ſilver in tale, they from thence began to be called *centenionales*, or "hundreders." Thoſe of Conſtantine I. and II. Conſtans, and Conſtantius, weigh from 50 grains down to 40; thoſe of Julian and Jovian, from 40 to 30, and of the ſucceeding emperors from the time of Juſtinian, from 30 to 20. Under Heraclius they ceaſed entirely; and from Juſtinian to their total abolition, had been brought down from 15 to 10 grains. A like decreaſe of weight took place in the milliarenſis; thoſe of Conſtantine and Conſtans being above 70 grains in weight; thoſe of Arcadius not above 60; and the milliarenſis of Juſtinian not more than 30 grains; but, from the weight of thoſe in Dr Hunter's cabinet, Mr Pinkerton deduces the medium to have been exactly $70\frac{8}{17}$ grains. Theſe coins were alſo called *majorinæ*.

66 Account of the ſmall Roman coins,

The ſmaller ſilver coins of Rome were, 1. The *quinarius*, at firſt called *victoriatus*, from the image of Victory on its reverſe; and which it continued to bear from firſt to laſt. Its original value was five aſes, but it was afterwards raiſed to eight, when the value of the denarius increaſed to 16. According to Pliny, it was firſt coined in conſequence of the *lex Clodia*, about the 525th year of Rome. Some are of opinion, that it was called κερατιον under the Conſtantinopolitan empire, becauſe it was worth a κερατιον of gold, 144 of which went to the ounce; but this is denied by Mr Pinkerton, becauſe at the time that the word κερατιον firſt appears in hiſtory, the denarius did not weigh above 30 grains; and of conſequence, as 25 muſt have gone to the gold ſolidus, of which there were ſix in the ounce, 130 denarii muſt have gone to the ounce of gold. He is therefore of opinion, that the word κερατιον was only another name for the denarius when much reduced in ſize: probably owing to the great ſcarcity of ſilver in Conſtantinople, though in the ſame city there was plenty of gold; and of conſequence, the gold ſolidus was never diminiſhed. "For Monteſquieu (ſays our author) has well obſerved, that gold muſt be common where ſilver was rare. Hence gold was the common regulation of accounts in the Eaſtern empire." The δικερατιον met with in ancient authors, according to Mr Pinkerton, was merely an improper name for the *milliarenſis*; when, on account of the ſcarcity of ſilver, the denarius was reduced, and no milliarenſis coined: ſo that the current milliarenſis of former reigns happened to be double to the denarius or centenonialis. The quinarius diminiſhes in ſize along with the other coins; thoſe of Auguſtus weighing 30 grains, of Severus 25, of Conſtantine I. 20, of Juſtinian 12, and of Heraclius only 5. A new ſilver coinage ſeems to have taken place after the days of this emperor; as the little we then meet with, which in the beſt cabinets ſcarce exceeds a dozen of coins, conſiſts entirely of large unſhapely pieces of coarſe metal.

67 Diviſion of the denarius.

2. The conſular denarius had alſo four ſilver ſeſtertii, till the as fell to half an ounce, when it was thought proper to coin the ſeſtertius in braſs, as it continued to be ever afterwards. "The very laſt ſilver ſeſtertius (Says Mr Pinkerton) which appears, is one with a head of Mercury, and H. S.; on the reverſe a Caduceus P. SEPVLLIVS; who appears to be the P. SEPVLLIVS MACER of the denarii of Julius Cæſar. If ſo, as is moſt probable, the ſeſtertius was coined in ſilver down to Auguſtus; and it is of courſe not to be expected that any of braſs can appear till Auguſtus, under whom they are actually quite common. I have indeed ſeen no coin which could be a conſular braſs ſeſtertius; and though we have certainly braſs dupondii of Cæſar, yet it is reaſonable to infer, that the braſs ſeſtertius was firſt coined by Auguſtus. Not one ſilver ſeſtertius appears during the whole imperial period, yet we know that the ſeſtertius was the moſt common of all ſilver coins. The conſular ſeſtertii of ſilver, marked H. S. are not uncommon, nor the quinarii; but the latter are very ſcarce of all the emperors, if we except one inſtance, the ASIA RECEPTA of Auguſtus.

68 Roman gold.

"The Roman gold coinage was ſtill later than that of ſilver. Pliny tells us, that "gold was coined 62 years after ſilver; and the ſcruple went for 60 ſeſterces. It was afterwards thought proper to coin 40 pieces out of the pound of gold. And our princes have by degrees diminiſhed their weight to 45 in the pound." This account is confirmed by the pieces which ſtill remain; for we have that very coin weighing a ſcruple, which went for 20 ſeſterces. On one ſide is the head of Mars, and on the other an eagle; and it is marked XX. We have another coin of the ſame kind, but double, marked XXXX; and its triple, marked ↓X or 60; the ↓ being the old numeral character for 50." Mr Pinkerton, the diſcoverer of this, treats other medalliſts with great aſperity. Savot and Hardouin are mentioned by name; the latter (he ſays) is "ignorant of common ſenſe;" and neither he nor Savot could explain it but by reading back-

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backward; but the ↓ for the Roman V, and thus making it xv. Other readings have been given by various medallists, but none have hit upon the true one excepting our author, though the coin itself led to it, being just three times the weight of that marked xx. We have likewise half the largest coin, which is marked xxx, and which weighs 26 grains; the smallest is only 17½; the xxxx weighs 34; and the LX or drachma 53. There is also the didrachm of this coinage, of 106 grains.

69 Account of the aurei.

The *aurei* or Roman gold coins, were at first 48 in the pound; but they were afterwards diminished in number to 40, owing to an augmentation in the weight of each coin. In the time of Sylla, the aureus weighed no less than from 164 to 168 grains, and there were only 30 in the pound; but such confusion in the coinage was introduced by that conqueror, that no person could know exactly what he was worth. Till this time the aureus seems to have continued of the value of 30 silver denarii, about one pound sterling; for about that time it was enlarged a whole third, that it might still be equivalent to the full number of denarii. But after Sylla had taken Athens, and the arts and manners of Greece became objects of imitation to the Romans, the aureus fell to 40 in the pound, probably when Sylla had abdicated his dictatorship. Thus, being reduced near to the scale of the Greek χρυσος, it passed for 20 denarii, as the latter did for as many drachmas, being in currency 13s. 4d. sterling. "This (says Mr Pinkerton) is the more probable, because we know from Suetonius, that the great Cæsar brought from Gaul so much gold, that it sold for nine times its weight of silver: but the Gallic gold was of a very base sort."

In the time of Claudius, the aureus was valued at 100 sestertii, or 25 silver denarii, at which it continued till the time of Heliogabalus, when it fell to about 92 grains at a medium, or rose in number to 55 in the pound. In the reign of Philip, during which the city completed its thousandth year, the aureus was coined of two or three sizes. These are impressed with a head of Rome on one side, and various figures on the other; but the workmanship is so rude, that they are supposed to have been struck in some of the more uncivilized provinces of the empire. The practice of having different gold coins, however, continued under Valerian, Gallienus, and his successors. In the time of Gallienus, they were of 30, 65, and from 86 to 93 grains; the double aurei being from 172 to 183½ grains; but the aureus properly so called was from 86 to 93; those of 30 and 32 being the *trientes aurei* of the *Historiæ Augustæ Scriptores;* while the larger, from 62 to 65, are to be accounted double trientes and were perhaps called *minuti aurei.* The value of these different sizes of aurei is not known.

70 Alteration in the gold coin made by Aurelian.

That Aurelian made some alteration in the coin is certain; but Mr Pinkerton supposed it to have been only in the gold; because under him and his successor Probus, the common aureus was of 100 grains, a size confined to those emperors: there are likewise halves of about 50 grains; and double aurei, commonly of very fine workmanship, of upwards of 200 grains. In the time of Gallienus, the precious metal was so common, that this emperor vied in magnificence with Nero and Heliogabalus. Aurelian, who plundered the rich city of Palmyra, and thus became master of the treasures of the east, obtained such a profusion of gold, that he looked upon it to be produced by nature in greater plenty than silver. It is remarkable, that during this emperor's reign there was a rebellion among the money-coiners, which could not be quelled but by the destruction of several thousands; which Mr Pinkerton ascribes to his having ordered the gold to be restored to its former size, but to go for no more silver than it formerly did. "So very little silver (says he) occurs of this period, that it is plain no alteration in the silver produced the war with the moneyers: and in the brass he made no change; or if he had, it were strange that such commotions should arise about so trifling a metal. But if, as appears from the coins, he ordered the aureus, which had fallen to 80 grains, to be raised to about 100, it is no wonder that the contractors should be in an uproar; for a whole quarter of their coinage, amounting as would seem to all their profits, was lost. Aurelian judged, that when he found gold so common in the east, it was equally so in the west; and that the moneyers must have made a most exorbitant profit; but his ideas on this subject were partial and unjust: and after his short reign, which did not exceed five months after the alteration, the gold returned to its former course; though a few pieces occur of Aurelian's standard, struck, as would seem, in the commencement of the reign of Probus his successor.

From this time to that of Constantine I. the aureus weighed between 70 and 80 grains; but in his reign it was changed for the solidus, of which six went to the ounce of gold, which went for 14 milliarenses, and 25 denarii as before; the value of silver being now to gold as 14 to 1. This new coin continued of the same value to the final downfall of the Constantinopolitan empire; gold being always very plentiful in that city, though silver became more and more scarce. The solidus was worth 12s. sterling. Here again our author most severely criticises Mr Clarke and Mr Raper: the former (he says) with respect to the value of gold in the time of Constantine I. "has left all his senses behind him. In page 267. he absurdly asserts, that 20 denarii went to the solidus in the time of Theodosius I. and proceeds with this deplorable error to the end of his work. He then tells us, that only 14 denarii went to the solidus under Constantine I. &c." To Mr Raper, however, he is a little more merciful, as he owns, that "though he (Mr Raper) has strangely confounded the milliarensis with the denarius, he has yet kept common sense for his guide." Mr Pinkerton argues, indeed with great probability, "that had any change in the coinage taken place between the time of Constantine and Theodosius I. that is, in less than 50 years, the laws of that period, which are all in the Theodosian code, must have noticed it." To this and other arguments upon the subject, Mr Pinkerton adds the following observation upon the value of gold and silver: "As a state advances to its height, gold increases in value; and as a state declines, it decreases, providing the metals are kept on a par as to purity. Hence we may argue, that gold decreased in its relation to silver perhaps four or five centuries, furnished most European kingdoms with gold in coin, which otherwise would, from their want of arts, and

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of intercourse with the east, then the grand seminary of that metal, have almost been ignorant of what gold was. These gold coins were called *Bezants* in Europe, because sent from Byzantium or Constantinople; and were *solidi* of the old scale, six to the ounce. In Byzantine writers, the solidus is also called *nomisma*, or "the coin;" *crysinos*, because of gold; *hyperperos*, from its being refined with fire, or from its being of bright gold flaming like fire. The *solidi* also, as the *aurei* formerly, received names from the princes whose portraits they bore; as *Michelati*, *Manuelati*. *Solidus* is a term used also for the aureus by Apuleius, who lived in the time of Antoninus the Philosopher; nay, as early as in the Prætorian edicts of the time of Trajan, It was then a distinction from the semissis or half. In the time of Valerian, when aurei of different sizes had been introduced, it became necessary to distinguish the particular aurei meant. Hence in the Imperial Rescripts, published by the *Historiæ Augustæ Scriptores*, Valerian uses the term *Philippeos nostri vultus*, for the common aurei. Aurelian uses the same term *aurei Philippei*, for the aurei which he had restored to their size in some degree. Gallienus uses *aurei Valeriani* for his father's coins. *Aurei Antoniniani* are likewise put by Valerian for coins of the early Antonini, of superior standard to any then used.

71 Divisions of the aureus.

In the first gold coinage at Rome, the aureus was divided into four parts; the semissis of 60 sestertii; the tremissis, or third, of 30; the fourth, the name of which is not mentioned, of 40; and the scrupulum of 20. But in a short time all of these fell into disuse, except the semissis or half, which is extremely scarce; so that it is probable that few have been struck. It is an erroneous opinion (according to Mr Pinkerton) that the semissis was called a *denarius aureus*. The aureus itself indeed had this name; but the name of *quinarius* is applied to the semissis with greater propriety than the former. Trientes, or tremisses of gold, are found of Valerian and his son Gallienus, and weigh about 30 grains. Those of Salonina the wife of Gallienus weigh 33 grains. Under the Constantinopolitan empire, tremisses again make their appearance; and from the time of Valentinian downwards, the thirds are the most common coins of gold, being worth about 4 s. sterling. The semissis is likewise mentioned, but none occur earlier than the time of Basiliscus. The gold tremissis was the pattern of the French and Spanish gold coins; as the silver denarius, in its diminished state, was of the Gothic and Saxon penny.

72 Account of the Roman method of coining.

We shall close this account of the Roman money with some remarks concerning the mint, and method of coinage. This at first seems to have been under the direction of the quæstor. About the time that silver was first coined in Rome, *viz.* about 266 B. C. the *triumviri monetales* were created. They were at first of senatorial rank, but were by Augustus chosen from among the equestrian; and the title of *triumviri* was continued till after the time of Caracalla; but under Aurelian there was probably but one master of the mint called *Rationalis*; and Mr Pinkerton is of opinion that the change took place under Gallienus. He seems also to have permitted the provincial cities to coin gold and silver, as well as to have altered the form of the mints in the capital, and to have ordered them all to strike money with Latin legends, and of the same forms; as in his time we first meet with coins with mint-marks of cities and offices. The violent insurrection which took place in his reign has already been mentioned, as well as its probable cause; and Mr Gibbon has shown, that the concealed enemies of Aurelian took such advantage of this insurrection, that it cost 7000 of his best troops before it could be quelled. About this time the *procurator monetæ* seems to have succeeded the *rationalis* as director of the mint. In the colonies, the direction of the mint seems to have been given to the decemviri, whose names frequently occur on colonial coins; "which (says Mr Pinkerton), though generally of rude invention, and ruder execution, are yet often interesting and important."

The engraving of the ancient dyes used in coinage was a work of much genius and labour; and at Rome Greek artists were generally employed in it; but it has been thought a matter of great surprise, that scarce any two ancient coins are to be found exactly the same. Hence some antiquaries have imagined, that only a single coin was thrown off from each dye. M. Beauvais informs us, that the only two Roman imperial coins of the first times which he had seen perfectly alike were those of the emperor Galba. It is, however, the opinion of the best judges, that a perfect similarity betwixt two medals is a very great reason for supposing one of them to be forged. "It must also be observed (says Mr Pinkerton), that the differences in coins, apparently from the same dye, are often so minute as to escape an eye not used to microscopic observations of this sort. But it would be surprising if any two ancient coins were now found struck with the same dye; for out of each million issued, not above one has reached us. Dyes soon give way by the violence of the work; and the ancients had no puncheons nor matrices, but were forced to engrave many dyes for the same coin. Even in our mint, upon sending for a shilling's worth of new halfpence, it will appear that three or four dyes have been used. Sometimes the obverse of the dye gives way, sometimes the reverse; but among us it is renewed by puncheons, though with variations in the lettering or other minute strokes; while the ancients were forced to recur to another dye differently engraven. The engravers of the dye were called *cælatores*; other officers employed in the mint were the *spectatores*, *expectatores*, or *nummularii*. The melters were styled *fusarii*, *flatuarii*, and *flaturarii*; those who adjusted the weight were called *æquatores monetarum*; those who put the pieces into the dye *suppositores*, and those who struck them *malleatores*. At the head of each office was an officer named *primicerius*, and the foreman was named *optio et exactor*."

In order to assist the high relief on the coins, the metal, after being melted and refined, was cast into bullets, as appears from the ancient coins not being cut or filed on the edges, but often cracked, and always rough and unequal. These bullets were then put into the dye, and received the impression by repeated strokes of the hammer, though sometimes a machine appears to have been used for this purpose: for Boiterue informs us, that there was a picture of the Roman mintage in a grotto near Baiæ, where a machine was represented holding up a large stone as if to let it fall suddenly, and strike the coin at once. None of the ancient money was cast in moulds, except-

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ing the most ancient and very large Roman brass, commonly called *weights*, and other Italian pieces of that sort; all the rest being mere forgeries of ancient and modern times. Some Roman moulds which have been found are a proof of this; and from these some medallists have erroneously imagined that the ancients first cast their money in mould, and then stamped it, in order to make the impression more clear and sharp.

The ancients had some knowledge of the method of crenating the edges of their coins, which they did by cutting out regular notches upon them; and of this kind we find some of the Syrian and ancient consular coins, with a few others. The former were cast in this shape, and then struck; but the latter were crenated by incision, to prevent forgery, by showing the inside of the metal: however, the ancient forgers also found out a method of imitating this; for Mr Pinkerton informs us, that he had a Roman consular coin, of which the incisions, like the rest. were plated with silver over the copper.

Sect. VI. *Of the Preservation of Medals.*

We now come to consider what it is that distinguishes one medal from another, and why some are so highly prized more than others. This, in general, besides its genuineness, consists in the high degree of preservation in which it is. This, by Mr Pinkerton, is called *conservation* of medals, and is by him regarded as *good* and as *perfect*. In this, he says that a true judge is so nice, that he will reject even the rarest coins if in the least defaced either in the figures or legend. Some, however, are obliged to content themselves with those which are a little rubbed, while those of superior taste and abilities have in their cabinets only such as are in the very state in which they came from the mint; and such, he says, are the cabinets of Sir Robert Austin, and Mr Walpole of Roman silver at Strawberryhill. It is absolutely necessary, however, that a coin be in what is called *good* preservation; which in the Greek or Roman emperors, and the colonial coins, is supposed to be when the legends can be read with some difficulty; but when the conservation is perfect, and the coin just as it came from the mint, even the most common coins are valuable.

73 Brass and copper best preserved by the rust that covers them.

The fine rust, like varnish, which covers the surface of brass and copper coins, is found to be the best preserver of them; and is brought on by lying in a certain kind of soil. Gold cannot be contaminated but by iron mold, which happens when the coin lies in a soil impregnated with iron; but silver is susceptible of various kinds of rust, principally green and red; both of which yield to vinegar. In gold and silver coins the rust must be removed, as being prejudicial; but in brass and copper it is preservative and ornamental; a circumstance taken notice of by the ancients. "This fine rust (says Mr Pinkerton), which is indeed a natural varnish not imitable by the art of man, is sometimes a delicate blue, like that of a turquoise; sometimes of a bronze brown, equal to that observable in ancient statues of bronze, and so highly prized; and sometimes of an exquisite green, a little on the azure hue, which last is the most beautiful of all. It is also found of a fine purple, of olive, and of a cream colour or pale yellow; which last is exquisite, and shows the impression to as much advantage as paper of cream colour, used in all great foreign presses, does copperplates and printing. The Neapolitan patina (the rust in question) is of a light green; and when free from excrescence or blemish is very beautiful. Sometimes the purple patina gleams thro' an upper coat of another colour, with as fine effect as a variegated silk or gem. In a few instances a rust of a deeper green is found: and it is sometimes spotted with the red or bronze shade, which gives it quite the appearance of the East Indian stone called the *blood-stone*. These rusts are all, when the real product of time, as hard as the metal itself, and preserve it much better than any artificial varnish could have done; concealing at the same time not the most minute particle of the impression of the coin."

74 Different kinds of this rust.

The value of medals is lowered when any of the letters of the legend are misplaced; as a suspicion of forgery is thus induced. Such is the the case with many of those of Claudius Gothicus. The same, or even greater, diminution in value takes place in such coins as have not been well fixed in the dye, which has occasioned their slipping under the strokes of the hammer, and thus made a double or triple image. Many coins of this kind are found in which the one side is perfectly well-formed, but the other blundered in the manner just mentioned. Another blemish, but of smaller moment, and which to some may be rather a recommendation, is when the workmen through inattention have put another coin into the dye without taking out the former. Thus the coin is convex on one side, and concave on the other, having the same figure upon both its sides.

75 Medals how diminished in value.

The medals said by the judges in this science to be *countermarked* are very rare, and highly valued. They have a small stamp impressed upon them, in some an head, in others a few letters, such as Aug: n. probus, &c. which marks are supposed to imply an alteration in the value of the coin; as was the case with the countermarked coins of Henry VIII. and Queen Mary of Scotland. Some have a small hole through them; sometimes with a little ring fastened in it, having been used as ornaments; but this makes no alteration in their value. Neither is it any diminution in the value of a coin that it is split at the edges; for coins of undoubted antiquity have often been found in this state, the cause of which has already been explained. On the contrary, this cracking is generally considered as a great merit; but Mr Pinkerton suspects that one of these cracked coins has given rise to an error with respect to the wife of Carausius who reigned for some time in Britain. The inscription is read oriuna Aug: and there is a crack in the medal just before the O of oriuna. Without this crack Mr Pinkerton supposes that it would have been read Fortuna Aug.

75 Countermarked medals.

Some particular soils have the property of giving silver a yellow colour as if it had been gilt. It naturally acquires a black colour through time, which any sulphureous vapour will bring on in a few minutes. From its being so susceptible of injuries, it was always mixed by the ancients with much alloy, in order to harden it. Hence the impressions of the ancient silver coins remain perfect to this day, while those of modern coins are obliterated in a few years. On this ac-

76 Silver and gold how tarnished.

Preservation.

account Mr Pinkerton expresses a wish, that modern states would allow a much greater proportion of alloy in their silver coin than they usually do. As gold admits of no rust except that from iron abovementioned, the coins of this metal are generally in perfect conservation, and fresh as from the mint.

77 How to cleanse them.

To cleanse gold coins from this rust, it is best to steep them in aquafortis, which, though a very powerful solvent of other metals, has no effect upon gold, Silver may be cleansed, by steeping for a day or two in vinegar, but more effectually by boiling in water with three parts of tartar and one of sea-salt; on both these metals, however, the rust is always in spots, and never forms an entire incrustation as on brass or copper. The coins of these two metals must never be cleansed, as they would thus be rendered full of small holes eaten by the rust. Sometimes, however, they are found so totally obscured with rust, that nothing can be discovered upon them; in which case it is best to clear them with a graver; but it may also be done by boiling them for 24 hours in water with three parts of tartar and one of alum; not sea-salt as in silver coins.

78 Why ancient coins are in such an high state of preservation.

The high state of preservation in which ancient coins are usually found, is thus accounted for by Mr Hancarville. He observes, that the chief reason is the custom of the ancients always to bury one or more coins with their dead, in order to pay for their passage over the river Styx. "From Phidon of Argos (says he) to Constantine I. are 36 generations: and from Magna Græcia to the Euphrates, from Cyrene to the Euxine Sea, Grecian arts prevailed, and the inhabitants amounted to about 30,000,000. There died therefore, in that time and region, not less than ten thousand millions of people, all of whom had coins of one sort or other buried with them. The tombs were sacred and untouched; and afterwards neglected, till modern curiosity or chance began to disclose them. The urn of Flavia Valentina, in Mr Towley's capital collection, contained seven brass coins of Antoninus Pius and Eleagabalus. Such are generally black, from being burnt with the dead. The best and freshest coins were used on these occasions from respect to the dead; and hence their fine conservation. At Syracuse a skeleton was found in a tomb, with a beautiful gold coin in its mouth; and innumerable other instances might be given, for hardly is a funeral urn found without coins. Other incidents also conspire to furnish us with numbers of ancient coins, though the above-recited circumstance be the chief cause of perfect conservation. In Sicily, the silver coins with the head of Proserpine were found in such numbers as to weigh 600 French livres or pounds. In the 16th century, 60,000 Roman coins were found at Modena, thought to be a military chest hid after the battle of Bedriacum, when Otho was defeated by Vitellius. Near Brest, in the year 1760, between 20 and 30,000 Roman coins were found. A treasure of gold coins of Lysimachus was found at Deva on the Marus; and Strabo, lib. vii. and Pausan *in Attic.* tell that he was defeated by the Getæ; at which time this treasure seems to have fallen into their hands.

79 Number of ancient coins.

Thus Mr Pinkerton, from the authority of Mr Hancarville and others; but considering these vast numbers of coins found in various places, it seems surprising how so few should now remain in the cabinets of the curious, as the same author informs us that the whole of the different ancient coins known to us amount only to about 80,000, though he owns that the calculation cannot be esteemed accurate.

How to distinguish true from counterfeits.

Sect. VII. *How to distinguish true Medals from counterfeits.*

The most difficult and the most important thing in the whole science of medals is the method of distinguishing the true from the counterfeit. The value put upon ancient coins made the forgery of them almost coeval with the science itself; and as no laws inflict a punishment upon such forgers, men of great genius and abilities have undertaken the trade; but whether to the real detriment of the science or not, is a matter of some doubt; for if only exact copies of genuine medals are sold for the originals, the imposition may be deemed trifling; but the case must be accounted very different, if people take it upon them to forge medals which never existed. At first the forgeries were extremely gross; and medals were forged of Priam, of Aristotle, Artemisia, Hannibal, and most of the other illustrious personages of antiquity. Most of these were done in such a manner, that the fraud could easily be discovered; but others have imposed even upon very learned men. Mr Pinkerton mentions a remarkable medal of the emperor Heraclius, representing him in a chariot on the reverse, with Greek and Latin inscriptions, which Joseph Scaliger and Lipsius imagine to have been struck in his own time, but which was certainly issued in Italy in the 15th century. "Other learned men (says our author) have been strangely misled when speaking of coins; for to be learned in one subject excludes not gross ignorance in others. Budæus, de Asse, quotes a denarius of Cicero, M. TULL. Erasmus, in one of his Epistles, tells us with great gravity, that the gold coin of Brutus' struck in Thrace, ΚΟΣΩΝ, bears the patriarch Noah coming out of the ark with his two sons, and takes the Roman eagle for the dove with the olive branch. Winkelman, in his letters, informs us, that the small brass piece with Virgil's head, reverse ΕΡΟ, is undoubtedly ancient Roman; and adds, that no knowledge of coins can be had out of Rome: but Winkelman, so conversant in statues, knew nothing of coins. It is from other artists and other productions that any danger of deceit arises. And there is no wonder that even the skilful are misled by such artists as have used this trade; for among them appear the names of Victor Gambello, Giovani del Cavino, called the PADUAN, and his son Alessandro Bassiano likewise of Padua, Benvenuto Cellini, Alessandro Greco, Leo Aretino Jacobo da Frezzo, Federigo Bonzagna and Giovani Jacopo, his brother; Sebastiano Plumbo, Valerio de Vicenza, Gorlæus a German, Carteron of Holland, and others, all or most of them of the 16th century; and Cavino the Paduan who is the most famous, lived in the middle of that century. The forgeries of Cavino are held in no little esteem, being of wonderful execution. His and those of Carteron are the most numerous many of the other artists here mentioned not having forged above two or three coins. Later forgers were

80 Coins forged by excellent artists.

How to distinguish true from counterfeits.

were Dervieu of Florence who confined himself to medallions, and Cogornier who gave coins of the 30 tyrants in small brass. The chief part of the forgeries of Greek medals which have come to my knowledge are of the first mentioned, and a very gross kind, representing persons who could never appear upon coin, such as Priam, Æneas, Plato, Alcibiades, Artemisiat, and others. The real Greek coins were very little known or valued till the works of Goltzius appeared, which were happily posterior to the æra of the grand forgers. Why later forgers have seldom thought of counterfeiting them cannot easily be accounted for, if it is not owing to the masterly workmanship of the originals, which sets all imitation at defiance. Forgeries however, of most ancient coins may be met with, and of the Greek among the rest.

81 Roman forgeries more conspicuous than Greek ones.

"The forgeries are more conspicuous among the Roman medals than any other kind of coins; but we are not to look upon all these as the work of modern artists. On the contrary, we are assured that many of them were fabricated in the times of the Romans themselves, some of them being even held in more estimation than the genuine coins themselves on account of their being plated, and otherwise executed in a manner to which modern forgers could never attain. Even the ancients held some of these counterfeits in such estimation, that Pliny informs us there were frequently many true denarii given for one false one."—Caracalla is said to have coined money of copper and lead plated with silver; and plated coins, the work of ancient forgers occur of many Greek cities and princes; nay, there are even forgeries of barbaric coins. "Some Roman coins (says Mr Pinkerton) are found of iron or lead plated with brass, perhaps trials of the skill of the forger. Iron is the most common; but one decursio of Nero is known of lead plated with copper. Neumann justly observes, that no historic faith can be put in plated coins, and that most faulty reverses, &c. arise from plated coins not being noticed as such. Even of the Roman consular coins not very many have ever been forged. The celebrated silver denarius of Brutus, with the cap of liberty and two daggers, is the chief instance of a consular coin of which a counterfeit is known. But it is easily rejected by this mark; in the true coin the cap of liberty is below the guard or hilt of the daggers; in the false, the top of it rises above that hilt."

82 Denarius of Brutus.

83 Imperial medals.

The imperial series of medals is the grand object of modern medallic forgeries; and the deception was at first extended to the most eminent writers upon the subject. The counterfeits are by Mr Pinkerton divided into six classes:

I. Such as are known to be imitations, but valued on account of the artists by which they are executed. In this class the medals of the Paduan rank highest; the others being so numerous, that a complete series of imperial medals of almost every kind, nay almost of every medallion, may be formed from among them. In France, particularly, by far the greater part of the cabinets are filled with counterfeits of the kind. They are distinguished from such as are genuine by the following marks: 1. The counterfeits are almost universally thinner. 2. They are never worn nor damaged. 3. The letters are modern. 4. They are either destitute of varnish entirely, or have a false one, which is easily known by its being black, shining, and greasy, and very easily hurt with the touch of a needle, while the varnish of ancient medals is as hard as the metal itself. Instead of the greasy black varnish above mentioned, indeed, they have sometimes a light green one, spotted with a kind of iron marks, and is composed of sulphur, verdigris, and vinegar. It may frequently be distinguished by the hairstrokes of the pencil with which it was laid on being visible upon it. 5. The sides are either filed or too much smoothed by art, or bear the marks of a small hammer. 6. The counterfeits are always exactly circular, which is not the case with ancient medals, especially after the time of Trajan.

How to distinguish true from counterfeits.

84 Paduan forgeries how known:

The Paduan forgeries may be distinguished from those of inferior artists by the following marks: 1. The former are seldom thinner than the ancient. 2. They very seldom appear as worn or damaged, but the others very frequently, especially in the reverse, and legend of the reverse, which sometimes, as in forged Othos, appear as half consumed by time. 3. The letters in moulds taken from the antique coins have the rudeness of antiquity. 4. False varnish is commonly light green or black, and shines too much or too little. 5. The sides of forged coins are frequently quite smooth, and undistinguishable from the ancient, though to accomplish this requires but little art. 6. Counterfeit medals are frequently as irregular in their form as the genuine; but the Paduan are generally circular, though false coins have often little pieces cut off, in perfect imitation of the genuine. 7. In cast coins the letters do not go sharp down into the metal, and have no fixed outline; their minute angles, as well as those of the drapery, are commonly filled up, and have not the sharpness of the genuine kind. Where the letters or figures are faint, the coin is greatly to be suspected.

85 Letters the principal criterion of medals:

The letters form the great criterion of medals, the ancient being very rude, but the modern otherwise; the reason of which, according to Cellini, is, that the ancients engraved all their matrices with the graver on burin, while the modern forgers strike theirs with a punch.

86 Vico's account of false patina

According to Vico, the false patina is green, black, russet, brown, grey, and iron-colour. The green is made from verdigris, the black is the smoke of sulphur, the grey is made of chalk steeped in urine, the coin being left for some days in the mixture. The russet is next to the natural, by reason of its being a kind of froth which the fire forces from ancient coins; but when false it shines too much. To make it they frequently took the large brass coins of the Ptolemies, which were often corroded, and made them red hot in the fire; put the coins upon them, and a fine patina adhered. Our author does not say in what manner the iron-covered patina was made. "Sometimes (adds he) they take an old defaced coin, covered with real patina, and stamp it anew; but the patina is then too bright in the cavities, and too dull in the protuberances. The trial of brass coins with the tongue is not to be despised; for if modern the patina tastes bitter or pungent, while if ancient it is quite tasteless."

Mr Pinkerton informs us, that all medallions from Julius Cæsar to Adrian are much to be suspected of forgery; the true medals of the first 14 emperors being

How to distinguish true from counterfeits.

ing exceedingly valuable, and to be found only in the cabinets of princes.

87 Medals cast from the Paduan forgeries.

II. The second class of counterfeit medals contains those cast from moulds taken from the Paduan forgeries, and others done by eminent masters. These are sometimes more difficult to be discovered than the former, because in casting them they can give any degree of thickness they please; and, filling the small sand-holes with mastic, they retouch the letters with a graver, and cover the whole with varnish. The instructions already given for the former class, however, are also useful for those of the second, with this addition, that medals of this class are generally lighter than the genuine, because fire rarefies the metal in some degree, while that which is struck is rather condensed by the strokes. In gold and silver medals there cannot be any deception of this kind; because these metals admit not of patina, and consequently the varnish betrays the imposition. The marks of the file on the margin of those of the second class are a certain sign of forgery; though these do not always indicate the forgery to be of modern date, because the Romans often filed the edges of coins to accommodate them to the purposes of ornament, as quarter guineas are sometimes put into the bottom of punch laddles. It is common to imitate the holes of medals made by time by means of aqua-fortis; but this destroys the sides of a coin more effectually than if it had been eat into naturally. The fraud, however, is not easily distinguished.

88 Medals cast from an antique.

III. *Medals cast in moulds from an antique.*—In this mode some forgers, as Beauvais informs us, have been so very careful, that they would melt a common medal of the emperor whom they meant to counterfeit, lest the quality of the metal should betray them. "This (says Mr Pinkerton) has been done in the silver Septimius Severus, with the reverse of a triumphal arch, for which a common coin of the same prince has been melted; and in other instances. Putting metals in the fire or upon hot iron to cleanse them, gives them an appearance of being cast; for some spot of the metal being softer than the other will run, which makes this one of the worst methods of cleaning medals.—The directions given for discovering the two former deceptions hold good also in this.

89 Ancient medals retouched.

IV. *Ancient medals retouched and altered.*—This is a class of counterfeits more difficult to be discovered than any other. "The art (says Mr Pinkerton) exerted in this class is astonishing; and a connoisseur is the less apt to suspect it, because the coins themselves are in fact ancient. The accute minds of the Italian artists exerted themselves in this way, when the other forgeries became common and known. With graving tools they alter the portraits, the reverses, and the inscriptions themselves, in a surprising manner. Of a Claudius struck at Antioch they make an Otho; of a Faustina, a Titiana; of a Julia Severa, a Didia Clara; of a Macrinus, a Pescennius, &c. Give them a Marcus Aurelius, he starts up a Pertinax, by thickening the beard a little, and enlarging the nose. In short, wherever there is the least resemblance in persons, reverses, or legends, an artist may from a trivial medal generate a most scarce and valuable one. This fraud is distinguishable by the false varnish which sometimes masks it; but, above all, by the letters of the legend, which are always altered. Though this be sometimes done with an artifice almost miraculous, yet most commonly the characters straggle, are disunited, and not in a line."

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In counterfeits of this kind sometimes the obverse is not touched, but the reverse made hollow, and filled with mastic coloured like the coin, and engraven with such device and legend as was most likely to bring a great price; others are only retouched in some minute parts, by which, however, the value of the coin is much diminished. "Against all these arts (says Mr Pinkerton), severe scrutiny must be made by the purchaser upon the medal itself; and the investigation and opinion of eminent antiquaries had upon its being altered, or genuine as it is issued from the mint.

90 Medals with new devices, or soldered.

V. *Medals impressed with new devices, or soldered.*—In the first article of this class the reverses have been totally filed off, and new ones impressed with a dye and hammer. This is done by putting the face or obverse, which ever is not touched, upon different folds of pasteboard, afterwards applying the dye and striking it with a hammer. The forgery in this class is very easily discovered, as the devices and inscriptions on the counterfeits are known not to exist on true medals: as the Pons Ælius on the reverse of Adrian; the Expeditio Judaica of the same emperor, &c. The difference of fabrication in the face or reverse will be discovered at the first glance by any person of skill.

The soldered medals consist of two halves belonging to different medals, sawed through the middle and then joined with solder. This mode of counterfeiting is common in silver and brass coins. "They will take an Antoninus, for example, and saw off the reverse, then solder to the obverse which they have treated in the same manner. This makes a medal, which from an unknowing purchaser, will bring an hundred times the price of the two coins which compose it. When the deceit is used in brass coins, they take care that the metals be of one hue; though indeed some pretenders in this way sometimes solder copper and brass together, which at once reveals the deceit. Medals which have a portrait on each side, and which are generally valuable, are the most liable to a suspicion of this fraud. To a very nice eye the minute ring of solder is always visible; and upon inserting a graver, the fabrication falls into halves."

In the same manner reverses are sometimes soldered to faces not originally belonging to them, as one mentioned by Petre Jobert of Domitian with an amphitheatre, a reverse of Titus joined to it. Another art is sometimes made use of in this kind of counterfeits, of which there is an instance of the temple of Janus upon Nero's medals; where the middle brass is taken off, and inserted in a cavity made in the middle of a large coin of that prince. In the coins of the lower empire, however, the reverses of medals are sometimes so connected with their obverses, that a suspicion of forgery sometimes occurs without any foundation. They are met with most commonly after the time of Gallienus, when such a number of usurpers arose, that it was difficult to obtain an exact portrait of their features; the coiners had not time, therefore, to strike a medal for these as they could have done for other emperors who reigned longer. Hence, on the reverse

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of a medal of Marius, who reigned only three days, there is PACATOR ORBIS, which shows that at that time they had reverses ready fabricated, to be applied as occasion might require.

91 Plated medals, &c.

VI. *Plated medals, or those which have clefts.*—It has been already remarked, that many true medals are cracked in the edges; owing to the repeated strokes of the hammer, and the little degree of ductility which the metal possesses. This the forgers attempt to imitate by a file; but it is easy to distinguish betwixt the natural and artificial cleft by means of a small needle. The natural cleft is wide at the extremity, and appears to have a kind of almost imperceptible filaments; the edges of the crack corresponding with each other in a manner which no art can imitate.

The plated medals which have been forged in ancient time were long supposed to be capable of resisting every effort of modern imitation; but of late years, "some ingenious rogues (says Mr Pinkerton) thought of piercing false medals of silver with a red hot needle, which gave a blackness to the inside of the coin, and made it appear plated to an injudicious eye. This fraud is easily distinguished by scraping the inside of the metal." It is, however, very difficult to distinguish the forgeries of rude money when not cast; and our author gives no other direction than to consult a skilful medallist. Indeed, notwithstanding all the directions already given, this seems to be a resource which cannot by any means with safety be neglected. A real and practical knowledge of medals "is only to be acquired (says he) by seeing a great number, and comparing the forged with the genuine. It cannot therefore be too much recommended to the young connoisseur, who wishes to acquire some knowledge in this way, to visit all the sales and cabinets he can, and to look upon all ancient medals with a very microscopic eye. By these means only is to be acquired that ready knowledge which enables at first glance to pronounce upon a forgery, however, ingenious. Nor let the science of medals be from this concluded to be uncertain; for no knowledge is more certain and immediate, when it is properly studied by examination of the real objects. A man who buys coins, trusting merely to his theoretic perusal of medallic books, will find himself woefully mistaken. He ought to study coins first, where only they can be studied, in themselves. Nor can it be matter of wonder or impilcation of caprice, that a medallist of skill should at one preception pronounce upon the veracity or falsehood of a medal; for the powers of the human eye, employed in certain lines of science, are amazing. Hence a student can distinguish a book among a thousand similar, and quite alike to every other eye: hence a shepherd can discern, &c.: hence the medallist can say in an instant, 'this is a true coin, and this is a false,' though to other people no distinction be perceptible."

92 Mr Pinkerton's directions for knowing medals.

93 Forgeries of modern coins.

Forgeries of modern coins and medals, Mr Pinkerton observes, are almost as numerous as of the ancient. The satyric coin of Louis XII. PERDAM BABYLONIS NOMEN, is a remarkable instance; the false coin is larger than the true, and bears date 1512. The rude coins of the middle ages are very early forged, and forgeries have accordingly become common. Forged coins of Alfred and other early princes of England have appeared, some of which have been done with great art. "The two noted English pennies of Rich. I. says our author, are of this stamp; and yet have imposed upon Messrs Folkes and Snelling, who have published them as genuine in the two best books upon English coins. But they were fabricated by the late Mr White of Newgate-street, a noted collector, who contaminated an otherwise fair character by such practices. Such forgeries, though easy, require a skill in the history and coinage of the time which luckily can hardly fall to the lot of a common Jew or mechanic forger. But the practice is detestable, were no gain proposed: and they who stoop to it must suppose, that to embarrass the path of any science with forgery and futility, implies no infamy. In forgeries of ancient coin, the fiction is perhaps sufficiently atoned for by the vast skill required; and the artist may plausibly alledge, that his attention was not to deceive, but to excite his utmost powers, by an attempt to rival the ancient masters. But no possible apology can be made for forging the rude money of more modern times. The crime is certainly greater than that which leads the common coiner to the gallows; inasmuch as it is committed with more ease, and the profit is incomparably larger."

Value.

SECT. VIII. *Of the Value of Medals.*

ALL ancient coins and medals, though equally genuine, are not equally valuable. In medals, as well as in every thing else, the scarcity of a coin stamps a value upon it which cannot be otherwise derived from its intrinsic worth. There are four or five degrees of rarity reckoned up; the highest of which is called *unique*. The cause is generally ascribed to the fewness of number thrown off originally, or to their having been called in, and recoined in another form. To the former cause Mr Pinkerton ascribes the scarcity of the copper of Otho and the gold of Pescennius Niger; to the latter that of the coinage of Caligula: "though this last (says he) is not of singular rarity; which shows that even the power of the Roman senate could not annihilate an established money; and that the first cause of rarity, arising from the small quantity originally struck, ought to be regarded as the principal."

94 Causes of the scarcity of medals in ancient cities.

In the ancient cities Mr Pinkerton ascribes the scarcity of coin to the poverty or smallness of the state; but the scarcity of ancient regal and imperial coins arises principally from the shortness of the reign; and sometimes from the superabundance of money before, which rendered it almost unnecessary to coin any money during the reign of the prince. An example of this we have in the scarcity of the shillings of George III. which shows that shortness of the reign does not always occasion a scarcity of coin; and thus the coins of Harold II. who did not reign a year, are very numerous, while those of Richard I. who reigned ten, are almost unique.

Sometimes the rarest coins lose their value, and become common. This our author ascribes to the high price given for them, which tempts the possessors to bring them to market; but chiefly to the discovering of hoards of them. The former cause took place with Queen Anne's farthings, some of which formerly sold at five guineas; nay, if we could believe the newspapers,

Value.

[94] Rare coins sometimes become common, and *vice versa*.

pers, one of them was some years ago sold for 960 l. the latter with the coins of Canute, the Danish king of England: which were very rare till a hoard of them was discovered in the Orkneys. As discoveries of this kind, however, produce a temporary plenty, so when they are dispersed the former scarcity returns; while on the other hand some of the common coins become rare through the mere circumstance of neglect.

95 Silver coins in what cases most esteemed.

As double the number of copper-coins of Greek cities are to be met with that there are of silver, the latter are of consequence much more esteemed; but the reverse is the case with those of the Greek princes. All the Greek civic coins of silver are very rare excepting those of Athens, Corinth, Messana, Dyrrhachium, Massilia, Syracuse, and some others. Of the Greek monarchic coins the most rare are the tetradrachms of the kings of Syria, the Ptolemies, the sovereigns of Macedon and Bithynia, excepting those of Alexander the Great and Lysimachus. Those of the kings of Cappadocia are of a small size, and scarce to be met with. Of those of Numidia and Mauritania, the coins of Juba the father are common: but those of the son and nephew Ptolemy scarce. Coins of the kings of Sicily, Parthia, and Judæa, are rare; the last very much so. We meet with no coins of the kings of Arabia and Comagene except in brass; those of the kings of Bosphorus are in electrum, and a few in brass, but all of them rare; as are likewise those of Philetenis king of Pergamus and of the kings of Pontus. In the year 1777, a coin of Mithridates sold for L.26, 5s. Didrachms of all kings and cities are scarce excepting those of Corinth and her colonies; but the gold coins of Philip of Macedon, Alexander the Great and Lysimachus, as has already been observed, are common. The silver tetradrachms of all kings bear a very high price. The didrachm of Alexander the Great is one of the scarcest of the smaller Greek silver coins; some of the other princes are not uncommon.

96 Greek copper coins.

In most cases the copper money of the Greek monarchs is scarce; but that of Hiero I. of Syracuse is uncommonly plenty, as well as that of several of the Ptolemies.

97 Roman consular coins.

The most rare of the consular Roman coins are those restored by Trajan: of the others the gold consular coins are the most rare, and the silver the most common; excepting the coin of Brutus with the cap of Liberty already mentioned, with some others. Some of the Roman imperial coins are very scarce, particularly those of Otho in brass; nor indeed does he occur at all on any coin struck at Rome: but the reason of this may with great probability be supposed to have been the shortness of his reign. His portrait upon the brass coins of Egypt and Antioch is very bad; as well as almost all the other imperial coins of Greek cities. The best likeness is on his gold and silver coins; the latter of which are very common. The Greek and Egyptian coins are all of small or middling size, and have reverses of various kinds; those of Antioch have Latin legends, as well as most of the other imperial coins of Antioch. They have no other reverse but the SC in a wreath, excepting in one instance or two of the large and middle brass, where the inscriptions are in Greek. Latin coins of Otho in brass, with figures on the reverse, are certainly false; though in the cabinet of D'Ennery at Paris there was an Otho in middle brass restored by Titus, which was esteemed genuine by connoisseurs.

98 Leaden Roman coins.

The leaden coins of Rome are very scarce: Most of them are pieces struck or cast on occasion of the saturnalia; others are tickets for festivals and exhibitions, both private and public. The common tickets for theatres were made of lead, as were the *contorniati*; perpetual tickets, like the English silver tickets for the opera. Leaden medallions are also found below the foundations of pillars and other public buildings, in order to perpetuate the memory of the founders. From the time of Augustus also we find that leaden seals were used. The work of Ticorini upon this subject, intitled *Piombi Antiochi*, is much recommended by Mr Pinkerton.

99 Of coins blundered in the mint-age.

The Roman coins, which have been blundered in the manner formerly mentioned, are very rare, and undeservedly valued by the connoisseurs. The blunders in the legends of these coins, which in all probability are the mere effects of accident, have been so far mistaken by some medallists, that they have given rise to imaginary emperors who never existed. A coin of Faustina, which has on the reverse SOUSTI. S. C. puzzled all the German antiquaries, till at last Klotz gave it the following facetious interpretation: *Sine omni utilitate sectamini tantas ineptias.*

100 Heptarchic coins of England.

The heptarchic coins of England are generally rare except those call *stycas*, which are very common, as well as those of Burgred king of Mercia. The coins of Alfred which bear his bust are scarce, and his other money much more so. Those of Hardyknute are so rare, that it was even denied that they had an existence; but Mr Pinkerton informs us, that there are three in the British museum, upon all of which the name HARTHCANUT is quite legible. No English coins of King John are to be met with, tho' there are some Irish ones; and only French coins of Richard I. "Leake (says Mr Pinkerton) made a strange blunder in ascribing coins of different kings with two faces, and otherwise spoiled in the stamping, to this prince; in which, as usual, he has been followed by a misled number."

101 Scottish coins.

Coins of Alexander II. of Scotland are rather scarce, but those of Alexander III. are more plentiful. Those of John Baliol are rare, and none of Edward Baliol to be found.

Sect. IX *Of the Purchase of Medals.*

Medals are to be had at the shops of goldsmiths and silversmiths, with those who deal in curiosities, &c. but in great cities there are professed dealers in them. The best method of purchasing medals, however, is that of buying whole cabinets, which are every year exposed to auction at London. In these the rare medals are sold by themselves; but the common ones are put up in large lots, so that the dealers commonly purchase them. Mr Pinkerton thinks it would be better that medals were sold one by one; because a lot is often valued and purchased for the sake of a single coin; while the others separately would sell for perhaps four times the price of the whole lot. "If any man of common sense and honesty (says Mr Pinkerton)

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kerton) were to take up the trade of selling coins in London, he would make a fortune in a short time. This profitable business is now in the hands of one or two dealers, who ruin their own interest by making an elegant study a trade of knavery and imposition. If they buy 300 coins for 10s. they will ask 3s. for one of the worst of them! nay, sell forged coins as true to the ignorant. The simpletons complain of want of business. A knave is always a fool."

102 Price of gold coins of Carthage, &c.

The gold coins of Carthage, Cyrene, and Syracuse, are worth about twice their intrinsic value as metal; but the other gold civic coins from 5l. to 30l. each. The only gold coins of Athens certainly known to exist are two lately procured by the British king. One of these remains in possession of his majesty, but the other was given by the queen to Dr Hunter. There was another in the British museum, but suspected not to be genuine. Dr Hunter's coin, then, if sold, would bear the highest price that could be expected for a coin.

103 Of silver coins,

The silver coins of Syracuse, Dyrrachium, Massilia, Athens, and a few other states, are common; the drachmas and coins of lesser size are worth about five shillings; the didrachms, tetradrachms, &c. from five to ten, according to their size and beauty; the largest, as might naturally be expected, being more valuable than the small ones. The tetradrachms, when of cities whose coins are common, are worth from 7s. 6d. to 1l. 1s. but it is impossible to put a value upon the rare civic coins; ten guineas have been given for a single one.

104 Greek copper coins.

The Greek copper coins are common; and are almost all of that kind called *small brass*; the middle size being scarce, and the largest in all ages prior to the Roman emperors extremely so. The common Greek coins of brass bring from 3d. to 18d. according to their preservation; but when of cities, whose coins are rare, much higher prices are given. "The want of a few cities, however (says Mr Pinkerton), is not thought to injure a collection; as indeed new names are discovered every dozen of years, so that no assortment can be perfect. To this it is owing that the rarity of the Grecian civic coins is not much attended to."

105 Gold coins of Philip and Alexander.

The gold coins of Philip and Alexander the Great being very common, bear but from five to ten shilllings above their intrinsic value; but those of the other princes, being rare, sell from 3l. to 30l. each, or even more.

The tetradrachms are the dearest of the silver monarchic money, selling from five to ten shillings; and if very rare, from 3l. to 30l. Half these prices may be obtained for the drachmas, and the other denominations in proportion.

106 Greek copper coins more are than the silver.

The Greek copper coins are for the most part scarcer than the silver, except the Syro-Græcian, which are common, and almost all of the size called small brass. "They ought (says Mr Pinkerton) to bear a high price; but the metal and similarity to the copper civic coins, which are common, keep their actual purchase moderate, if the seller is not well instructed, and the buyer able and willing to pay the price of rarity."

The name of weights given to the ancient Roman ases is, according to our author exceedingly improper; as that people had weights of lead and brass sides, without the least appearance of a portrait upon them. These denote the weight by a certain number of knobs; and have likewise small *fleurettes* engraved upon them. According to Mr Pinkerton, whenever we meet with a piece of metal stamped on both sides with busts and figures, we may lay it down as a certain rule that it is a coin; but when slightly ornamented and marked upon one side only, we may with equal certainly conclude it to be a weight.

107 Price of the ancient Roman ases.

The ancient Roman ases are worth from 2s. to 2l. according to the singularity of their devices. Consular gold coins are worth from 1l. to 5l. Pompey with his sons 21l. and the two Bruti 25l. The silver coins are universally worth from a shilling to half a crown; excepting that of the cap of Liberty and a few others, which if genuine will bring from 10s. to 5l. The consular copper bears an equal price with the silver, but is more rare; the consular silver coins restored by Trajan are worth 20s. each.

With regard to the Roman imperial coins, it is to be observed, that some of those which belong to princes whose coins are numerous, may yet be rendered extremely valuable by uncommon reverses. Mr Pinkerton particularly points out that of Augustus, with the legend C. Marius Trogvs, which is worth three guineas, though the silver coins of that prince in general are not worth above a shilling. In like manner, the common gold coins of Trajan are not worth above twenty shillings, while those with *Basilica Ulpia, Forum Trajani, Divi nerva et Trajanus, Pater, Divi Nerva et Platina Ang. Profectio Aug. Regna Assignata, Rex Parthus*, and some others, bear from three to six pounds. The ticket medals belong to the Roman Senate, and are worth from three to ten shillings. The forged coins and medallions of the Paduan sell from one to three shillings each.

108 Barbaric coins.

Of the coins of other nations, those of Hilderic king of the Vandals are in silver, and worth 10s.; the small brass of Athanaric, 5 s.; the gold of Theodoric 2 l.; the second brass of Theodahat 5 s.; the second brass of Badueta rare, and worth 10 s.; the third brass, 3 s. The British coins are very rare, and worth from ten shillings to two guineas each, sometimes much more. Medals with unknown characters are always scarce and dear. Saxon pennies of the heptarchy are rare, and worth from ten shillings to *ten pounds*, according to their scarcity and preservation. The coins of the English kings are common; those of Edward the Confessor, in particular; others are rare and worth from ten shillings to two guineas, while two of Hardyknute are worth no less than ten guineas. The gold medals of Henry, in 1545, and the coronation of Edward, are worth 20l. each: the Mary of Trezzo, 3 l.; Simon's head of Thurloe in gold is worth 12 l.; his oval medal in gold upon Blake's naval victory at sea is worth 30 l.; and his trial piece, if brought to a sale, would, in Mr Pinkerton's opinion, bring a still higher price. The medals of Queen Anne, which are intrinsically worth about two guineas and a half, sell for about 3 l. each; the silver, of the size of a crown piece, sell for 10 s. and the copper from five to ten shillings. Dassier's copper pieces sell from two to five shillings, and a few bear a higher price.

The Scottish gold coins sell higher than the English.

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lish, but the others are on a par. The shilling of Mary with the bust is rare, and sells for no less than 30 l.; the half 3 l.; and the royal 5 l. 5 s. The French testoon of Francis and Mary brings 10 l. 10 s. and the Scottish one of Mary and Henry would bring 50 l. as would also the medal of James IV. The coronation medal of Francis and Mary is worth 20 l. Briot's coronation medal sold in 1755 only for two guineas at Dr Mead's sale; but would now bring 20 l. if sold according to rarity.

109 Gold coins of Scotland

110 English coins struck in Ireland.

The English coins struck in Ireland are of much the same price with those of the native country; but the St Patrick's halfpence and farthings are rather scarce, and the rare crown of white metal is worth 4 l. The gun-money of James II. and all other Irish coins are very common.

Sect. X. *Arrangement of Medals, with the Instructions to be derived from them.*

Having thus given a full account of every thing in general relative to medals, we must come to some particulars respecting their arrangement, and the entertainment which a medallist may expect from the trouble and expence he is at in making a collection.

It has already been observed, that one of the principal uses of medals is the elucidation of ancient history. Hence the arrangement of his medals is the first thing that must occur in the formation of a cabinet. The most ancient medals with which we are acquainted are those of Alexander I. of Macedon, who began to reign about 501 years before Christ. The series ought of consequence to begin with him, and to be succeeded by the medals of Sicily, Caria, Cyprus, Heraclia, and Pontus. Then follow Egypt, Syria, the Cimmerian Bosphorus, Thrace, Bithynia, Parthia, Armenia, Damascus, Cappadocia, Paphlagonia, Pergamus, Galatia, Cilicia, Sparta, Præonia, Epirus, Illyricum, Gaul, and the Alps, including the space of time from Alexander the Great to the birth of Christ, and which is to be accounted the third medallic series of ancient monarchs. The last series goes down to the fourth century, including some of the monarchs of Thrace, Bosphorus, and Parthia, with those of Comagene, Edessa or Osrhoene, Mauritania, and Judæa. A most distinct series is formed by the Roman emperors, from Julius Cæsar to the destruction of Rome by the Goths; nay for a much longer period, were it not that towards the latter part of it the coins become so barbarous as to destroy the beauty of the collection. Many series may be formed of modern potentates.

By means of medals we can with great certainty determine the various ornaments worn by ancient princes as badges of distinction. The Grecian kings have generally the diadem, without any other ornament; and though in general the side of the face is presented to view, yet in some very ancient Greek and Roman consular coins, full faces of excellent workmanship are met with. On several coins also two or three faces are to be seen, and these are always accounted very valuable.

111 Diadem an ancient emblem of sovereign authority.

The diadem, which was no more than a ribbon tied round the head with a floating knot behind, adorns all the Grecian princes from first to last, and is almost an infallible mark of sovereign power. In the Roman consular coins it is seen in conjunction with Numa and Ancus, but never afterwards till the time of Licinius, the colleague of Constantine. Diocletian, indeed, according to Mr Gibbon, first wore the diadem, but his portrait upon coins is never adorned with it. So great an aversion had the Romans to kingly power, that they rather allowed their emperors to assume the radiated crown, the symbol of divinity, than to wear a diadem; but after the time of Constantine it becomes common. The radiated crown appears first on the posthumous coins of Augustus as a mark of deification, but in somewhat more than a century became common.

The laurel crown, at first a badge of conquest, was afterwards permitted by the senate to be worn by Julius Cæsar, in order to hide the baldness of his head. From him all the emperors appear with it on their medals, even to our own times. In the lower empire the crown is sometimes held by a hand above the head, as a mark of piety. Besides these, the naval, mural, and civic crowns, appear on the medals both of emperors and other eminent men, to denote their great actions. The laurel crown is also sometimes worn by the Greek princes. The Arsacidæ of Parthia wear a kind of sash round the head, with their hair in rows of curls like a wig. The Armenian kings have the *tiara*, a kind of cap which was esteemed the badge of imperial power in the east. Conical caps are seen on the medals of Xerxes, a petty prince of Armenia, and Juba the father, the former having a diadem around it.

112 Symbols of divinity of the coins of Alexander and his successors.

The impious vanity of Alexander and his successors in assuming divine honours is manifest on their medals, where various symbols of divinity are met with. Some of them have an horn behind their ear, either to denote their strength, or that they were the successors of Alexander, to whom this badge might be applied as the son of Jupiter Ammon. This, however, Mr Pinkerton observes, is the only one of these symbols which certainly denotes an earthly sovereign, it being doubted whether the rest are not all figures of gods.—According to Eckhet, even the horn and diadem belong to Bacchus, who invented the latter to cure his headachs; and, according to the same author, the only monarch who appears on coins with the horn is Lysimachus. We are informed, however, by Plutarch, that Pyrrhus had a crest of goats horns to his helmet; and the goat we know was a symbol of Macedon. Perhaps the successors of Alexander wore this badge of the horn in consequence. The helmet likewise frequently appears on the heads of sovereigns, and Constantine I. has helmets of various forms curiously ornamented.

The diadem is worn by most of the Greek queens, by Orodaltis, daughter of Lycomedes, king of Bithynia; and though the Roman empresses never appear with it, yet this is more than compensated by the variety of their head-dresses. Sometimes the bust of an empress is supported by a crescent, to imply that she was the moon as her husband was the sun of the state. The toga, or veil drawn over the face, at first implied that the person was invested with the pontifical office; and accordingly we find it on the busts of Julius Cæsar, while Pontifex Maximus. It likewise implies the au-

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guiſhip, the augurs having a particular kind of gown called *lana*, with which they covered their heads when obſerving an omen. In latter times this implies only conſecration, and is common in coins of empreſſes. It is firſt met with on the coins of Claudius Gothicus as the mark of conſecration of an emperor. The *nimbus*, or glory, now appropriated to ſaints, has been already mentioned. It is as ancient as Auguſtus, but is not to be met with on many of the imperial medals, even after it began to be appropriated by them. There is a curious coin, which has upon the reverſe of the common piece with the head of Rome URBS ROMA, in large braſs, Conſtantine I. ſitting amidſt victories and genii, with a triple crown upon his head for Europe, Aſia, and Africa, with the legend SECURITAS ROMÆ.

113 Portraits upon medals.

In general only the buſt is given upon medals, though ſometimes half the body or more; in which latter caſe the hands often appear with enſigns of majeſty in them; ſuch as the globe ſaid to have been introduced by Auguſtus as a ſymbol of univerſal dominion; the ſceptre ſometimes confounded with the conſular ſtaff, a roll of parchment, the ſymbol of legiſlative power, and an handkerchief expreſſive of the power over the public games, where the emperor gave the ſignal. Some princes hold a thunderbolt, ſhowing that their power on earth was equal to that of Jupiter in Heaven; while others hold an image of Victory.

Medals likewiſe afford a good number of portraits of illuſtrious men; but they cannot eaſily be arranged in chronological order, ſo that a ſeries of them is not to be expected. It is likewiſe vain to attempt the formation of a ſeries of gods and goddeſſes to be found on ancient coins. Mr Pinkerton thinks it much better to arrange them under the ſeveral cities or kings whoſe names they bear. A collection of the portraits of illuſtrious men may likewiſe be formed from medals of modern date.

114 Reverſes of Greek and Roman coins.

The reverſes of ancient Greek and Roman coins afford an infinite variety of inſtruction and amuſement. They contain figures of deities at full length, with their attributes and ſymbols, public ſymbols and diverſions, plants, animals, &c. &c. and in ſhort almoſt every object of nature or art. Some have the portrait of the queen, ſon, or daughter of the prince whoſe image appears on the face or obverſe; and theſe are eſteemed highly by antiquaries, not only becauſe every coin ſtamped with portraits on both ſides is accounted valuable, but becauſe they render it certain that the perſon repreſented on the reverſe was the wife, ſon, or daughter of him who appears on the obverſe; by which means they aſſiſt greatly in the adjuſting of a ſeries. Some, however, with two portraits are common, as Auguſtus, the reverſe of Caligula; and Marcus Aurelius, reverſe of Antoninus Pius.

We find more art and deſign in the reverſes of the Roman medals than of the Greek: but, on the other hand, the latter have more exquiſite relief and workmanſhip. The very ancient coins have no reverſes, excepting a rude mark ſtruck into the metal reſembling that of an inſtrument with four blunt points on which the coin was ſtruck; and was owing to its having been fixed by ſuch an inſtrument on that ſide to receive the impreſſion upon the other. To this ſucceeds the image of a dolphin, or ſome ſmall animal, in one of the departments of the rude mark, or in an hollow ſquare; and this again is ſucceeded by a more perfect image, without any mark of the hollow ſquare. Some of the Greek coins are hollow in the reverſe, as thoſe of Caulonia, Crotona, Metapontum, and ſome other ancient cities of Magna Grecia. About 500 B. C. perfect reverſes appear on the Greek coins, of exquiſite relief and workmanſhip. "The very muſcles of men and animals (ſays Mr Pinkerton) are ſeen, and will bear inſpection with the largeſt magnifier as ancient gems. The ancients certainly had not eyes different from ours; and it is clear that they muſt have magnified objects. A drop of water forms a microſcope; and it is probable this was the only one of the ancients. To Greek artiſts we are indebted for the beauty of the Roman imperial coins; and theſe are ſo highly finiſhed, that on ſome reverſes, as that of Nero's decurſion, the *adventus* and *progreſſio* of various emperors, the *fundator pacis* of Severus, the features of the emperor, riding or walking, are as exact as on the obverſe. But though the beſt Greek artiſts were called to Rome, yet the Greek coins under the Roman emperors are ſometimes well executed, and always full of variety and curioſity. No Roman or Etruſcan coins have been found of the globular form, or indented on the reverſe like the early Greek. The firſt Greek are ſmall pieces of ſilver, while the Roman are larger maſſes of copper. The former are ſtruck; the latter caſt in moulds. The reverſes of the Roman coins are very uniform, the prow of a ſhip, a car, or the like, till about the year 100 B. C. when various reverſes appear on their conſular coins in all metals. The variety and beauty of the Roman imperial reverſes are well known. The medalliſt much values thoſe which have a number of figures; as the *Puellæ Fauſtinianæ*, of Fauſtina, a gold coin no larger than a ſixpence, which has 12 figures: that of Trajan, *regna aſſignata*, has four; the *congiarium* of Nerva five; the allocution of Trajan ſeven; of Hadrian 10; of Probus 12. Some Roman medals have ſmall figures on both ſides, as the *Apolloni ſancto* of Julian II. Such have not received any peculiar name among the medalliſts. Others have only a reverſe, as the noted *ſpintriati*, which have numerals I. II. &c. on the obverſe."

115 Of the deities repreſented upon ancient coins.

The *names* of the deities repreſented on the reverſes of Greek coins are never expreſſed; perhaps, as Mr Pinkerton ſuppoſes, out of piety, a ſymbolical repreſentation of their attributes being all that they thought proper to delineate; but the Roman coins always expreſs the name, frequently with an adjunct, as VENERI VICTRICI, &c. In others, the name of the emperor or empreſs is added; as PUDICITIÆ AUGUSTÆ, round an image of Modeſty; VIRTUS AUGUSTI, a legend for an image of Virtue.

The principal ſymbols of the divine attributes to be met with on the Greek medals are as follow:

1. Jupiter is known on the coins of Alexander the Great by his eagle and thunderbolts; but when the figure occurs only on the obverſe of coins, he is diſtinguiſhed by a laurel crown, and placid bearded countenance. Jupiter Ammon is known by the ram's-horn twiſting round his ear; a ſymbol of power and ſtrength, aſſumed by ſome of the ſucceſſors of Alexander the Great, particularly by Lyſimachus.

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2. Neptune is known by his trident, dolphin, or being drawn by sea-horses; but he is seldom met with on the Grecian coins.

3. Apollo is distinguished by an harp, branch of laurel, or tripod; and sometimes by a bow and arrows. In the character of the Sun, his head is surrounded with rays; but when the bust only occurs, he has a fair round face, and is crowned with laurel. He is frequent on the coins of the Syrian princes.

4. Mars is distinguished by his armour, and sometimes by a trophy on his shoulders. His head is armed with a helmet, and has a ferocious countenance.

5. Mercury is represented as a youth, with a small cap on his head, wings behind his ears and on his feet. He is known by the cap, which resembles a small hat, and the wings. He appears also with the caduceus, or wand twined with serpents, and the *marsupium*, or purse, which he holds in his hand.

6. Æsculapius is known by his bushy beard, and his leaning on a club with a serpent twisted round it. He sometimes occurs with his wife Hygeia or Health, with their son *Telesphorus* or Convalescence between them.

7. Bacchus is known by his crown of ivy or vine, his diadem and horn, with a tyger and satyrs around him.

8. The figure of Hercules is common on the coins of Alexander the Great, and has frequently been mistaken for that of the prince himself. He appears sometimes as a youth and sometimes with a beard. He is known by the club, lion's skin, and remarkable apparent strength; sometimes he has a cup in his hand, and a poplar tree, as a symbol of vigour, is sometimes added to the portrait.

9. The Egyptian Serapis is known by his bushy beard, and a measure upon his head.

10. Apis is delineated in the form of a bull, with a flower of the lotos, the water lilly of the Nile, supposed by Macrobius to be a symbol of creation and Jamblichus tells us, that Osiris was thought to have his throne in it.

11. Harpocrates, the god of Silence, appears with his finger on his mouth; sometimes with the sistrum in his left hand; a symbol common to most of the Egyptian deities.

12. Canopus, another Egyptian deity, appears in the shape of a human head placed on a kind of pitcher. "This deified pitcher (says Mr Pinkerton) seems to refer to an anecdote of ancient superstition, which, I believe, is recorded by Plutarch. It seems some Persian and Egyptian priests had a contest which of their deities had the superiority. The Egyptian said, that a single vase, sacred to Serapis, would extinguish the whole power of the Persian deity of fire. The experiment was tried; and the wily Egyptian, boring holes in the vase and stopping them with wax, afterwards filled the vase with water; which, gushing through the holes as the wax melted, extinguished the Persian deity. Hence the vase was deified."

13. The *Holy Senate* and *Holy People*, appear frequently on Greek imperial coins, sometimes represented as old men with beards, at others as youths.

The goddesses represented on medals are,

1. Juno, represented by a beautiful young woman, sometimes with a diadem, sometimes without any badge, which is reckoned a sufficient distinction, as the other goddesses all wear badges. Sometimes she appears as the goddess of marriage; and is then veiled to the middle and sometimes to the toes. She is known by the peacock, a bird sacred to her from the fable of Argus.

2. Minerva is very common on the coins of Alexander the Great; and her bust has been mistaken by the celebrated painter Le Brun for the hero himself. She is very easily distinguished by the helmet. Her symbols are, her armour; the spear in her right hand, and the ægis, with a Medusa's head, in her left; an owl commonly standing by her.

3. Diana of Ephesus is commonly represented on the Greek imperial coins; and appears with a great number of breasts, supposed to denote universal nature. She is supported by two deer, and carries a pannier of fruit upon her head. The bust of this goddess is known by the crescent on her brow, and sometimes by the bow and quiver at her side

4. Venus is known by an apple, the prize of beauty, in her hand. Sometimes she is distinguished only by her total want of dress; but is always to be known by her extraordinary beauty, and is sometimes adorned with pearls about the neck.

5. Cupid is sometimes met with on the Syrian coins, and is known by his infancy and wings.

6. Cybele is known by a turreted crown and lion; or is seen in a chariot drawn by lions.

7. Ceres is known by her garland of wheat, and is common on the Sicilian coins; that island being remarkable for its fertility. Sometimes she has two serpents by her, and is sometimes drawn in a chariot by them. She carries in her hands the torches with which she is fabled to have gone in search of her daughter Proserpine.

8. Proserpine herself is sometimes met with on coins with the name of κορη or the *girl*.

1. The Egyptian Isis has a bud or flower on her head; a symbol of the perpetual bloom of the inhabitants of heaven. She carries also a sistrum in her hand.

10. The Sidonian Astarte appears on a globe supported on a chariot with two wheels, and drawn by two horses.

These are the deities most commonly represented on the Greek coins. The more uncommon are, Saturn with his scythe, or with a hook on the Heraclian coins; Vulcan with his tongs, on the reverse of a coin of Thyatira, represented at work in the presence of Minerva. Adranus, a Sicilian god, is somteimes represented on coins with a dog. Anubis, an Egyptian deity, has a dog's head. Atis is known by his Phrygian bonnet; Castor and Pollux by a star on the head of each; Dis, by his old face, dishevelled hair and beard, and a hook; Flora by her crown of flowers; Nemesis by her wheel; and Pan by his horns and ears belonging to some kind of beast.

116 Table of Symbols.

There are likewise to be found on medals many different symbols by themselves; of the most remarkable of which we shall give the following table, with their significations:

Symbols.	Signification.
1. Vases with sprigs,	Solemn games,
2. Small	

Arrangement, &c.

Symbols.	Signification.
2. Small chest or hamper, with a serpent leaping out,	Mystic rites of Bacchus.
3. Anchor on Selucian medals,	Coin struck at Antioch, where an anchor was dug up.
4. Apollo on Syrian coins, on an inverted hamper.	Covered tripod.
5. Bee,	Aristeus the Son of Apollo.
6. Laurel,	Apollo.
7. Reed,	A river.
8. Ivy and grapes,	Bacchus.
9. Poppy,	Ceres and Proserpine.
10. Corn,	Ceres.
11. Owl and olive,	Minerva.
12. Dove,	Venus.
13. Torch,	Diana, Ceres, Or Proserpine.
14. Mudnis, or conic stone,	The sun, Belus, or Venus.
Symbols of Countries, &c.	
15. Pomegranate flowers,	Rhodes.
16. Owl,	Athens.
17. Pegasus,	Corinth.
18. Wolf's head,	Argos.
19. Bull's head,	Bœotia.
20. Minotaur's head and labyrinth,	Crete.
21. Horse's head,	Pharsalia.
22. Lion,	Marseilles.
23. Tortoise,	Peloponnesus.
24. Sphinx,	Scio.
25. Three legs joined, as in the Isle of Man-money,	Sicily.
26. Horse,	Thessaly.
27. The crescent,	Byzantium(A)
28. Bull,	Supposed to be a river.
29. Ensign, with the letters COL.	A colony drawn from one legion.
30. Bull,	Apis, strength or security.
31. Caduceus,	Peace and concord.
32. Cornucopia,	Abundance.
33. Pontificial hat,	Priesthood.
34. Parazonium,	Baton of command.

Symbols.	Signification.
35. Globe on an altar with three stars.	The world preserved by the gods for the three sons of Constantine I.
36. Fort and gate,	Security.
37. Tribuli, a kind of Chevaux de Frize,	Unknown.
38. Altar or tripod,	Piety.
39. Dolphin,	Apollo.
40. Lectisternia,	Festivals.
41. Mituus, or twisted wand,	Augurship.
42. Apex, or cap with strings,	Pontificate.
43. Thensa, or chariot employed to carry images,	Consecration of an empress.
44. Peacock,	Ditto.
45. Eagle,	Consecration of an emperor.

117 Legends of Medals.

The legends put upon medals are designed as explanations of them; but as the compass of even the largest coins does not admit of any great length of inscription, it has always been found necessary to use abbreviations; and in readily decyphering these lies a considerable part of the difficulty of the science. This, however, is greater in the Roman than in the Greek medals; for the Greeks commonly insert as much of the word as is sufficient to enable us easily to understand its meaning; but it is common for those who attempt to explain letters that do not often occur, to fall into very ridiculous errors. Of this Mr Pinkerton gives a most remarkable instance in Fortunius Licetus, a learned man, who finding upon a coin of Adrian the letters T. D. signifying the 14th year of that emperor's reign, imagined that they signified *Lucernas invenit Delta;* "Delta invented lanthorns;" and thence ascribed the origin of lanthorns to the Egyptians. Tables explaining the meaning of the Abbreviations found upon medals have been published by Patin, Ursatus, and others.

118 Extraordinary mistake of Fortunius Licetus.

Sect. XI. *Of Medallions, Medalets,* &c.

Besides the ordinary coins of the ancients, which passed in common circulation through the country, there were others of a larger size, which are now termed *medallions*. These were struck on the commencement of the reign of a new emperor and other solemn occasions: frequently also, by the Greeks in particular, as monuments of gratitude or of flattery. Sometimes they were mere trial or pattern pieces; and those abound after the time of Maximian with the words *Tres Monetæ* on the reverse. The common opinion is,

(A) This appears on the early coins of Byzantium, with the legend BYZANTIN ΣΩΤ. "the preserver of Byzantium." The reason of this was, that when Philip of Macedon besieged the city, and was about to storm it in a cloudy night, the moon shone out on a sudden and discovered him; by which means the inhabitants had time to collect their forces and repulse him. The Turks, on entering Constantinople, found this badge in many places: and suspecting some magical power in it, assumed the symbol and its power to themselves: so that the crescent is now the chief Turkish ensign.

Medallions, &c.

is, that all the Roman pieces of gold exceeding the denarius aureus, all in silver exceeding the denarius, and all in brass exceeding the sestertius, went under the denomination of *medallions:* but Mr Pinkerton thinks that many of these large pieces went in circulation, though not very commonly, as the five and two guinea pieces, silver crowns, &c. do in Britain. The finest medallions were presented by the mint-masters to the emperor, and by the emperor to his friends, as specimens of fine workmanship. The best we have at present are of brass, and many of them composed of two sorts of metal; the centre being copper, with a ring of brass around it, or the contrary: and the inscription is sometimes confined to one of the metals, sometimes not. There is a remarkable difference between the Greek and Roman medallions in point of thickness; the latter being frequently three or four lines thick, while the other seldom exceed one. Very few medallions, however, were struck by the Greeks before the time of the Roman emperors; but the Greek medallions of the emperors are more numerous than those of the Romans themselves. All these pieces, however, are of such high price that few private persons are able to purchase them. In the last century Christina queen of Sweden procured about 3000. In the king of France's collection there are 1200: a number formerly supposed not to exist; and Dr Hunter's collection contains about 400, exclusive of the Egyptian.

Besides these large pieces, there are smaller ones of a size somewhat larger than half-crowns; and by Italian medallists are called *medaglion cini*, or small medallions. They are still scarcer than the large kind.

119 Of medalets.

There is still a third kind, which have almost escaped the notice of medallists, viz. the small coins or *missilia* scattered among the people on solemn occasions; such as those struck for the slaves on account of the saturnalia; counters for gaming; tickets for baths and feasts; tokens in copper and in lead; &c. These are distinguished by Mr Pinkerton by the name of *medalets*. Many, or perhaps almost all, of those struck for the saturnalia, were satyrical; as the slaves had then a licence to ridicule not only their masters but any person whatever. Mr Pinkerton mentions one of the most common pieces of this kind, which has on the obverse the head of an old woman veiled, with a laurel crown; the reverse only s. c. within a wreath. Baudelot is of opinion that it is the head of Acca Laurentia, the nurse of Romulus, to whom a festival was ordained. "Perhaps (says Mr Pinkerton), it was struck in ridicule of Julius Cæsar; for the manner of the laurel crown, and its high appearance over the head, perfectly resemble that of Julius on his coins." Some have a ship upon one side; on the reverse T, or a cross, which was the image of Priapus; and occasioned many false invectives against the first Christians, who paid such respect to the cross. Some pieces have the heads of the emperors upon one side; on the reverse only numerals III. IV. V. &c. and the noted *spintriati* of Tacitus. Both these kinds appear to be tickets for the baths, as the number seems to denote the particular bath. Some have the head of a girl, with a vessel used at the baths in her hand. The spintriati are so immodest, that few will bear mention. But some are merely ludicrous; as one which has an ass with a bell about his neck, and a soldier riding him; another with two figures hoisting a woman in a basket into the air. Of those that will just bear mention, is a man with titles around him, as chief of the games; and a woman in ridicule of the modest bath-girl abovementioned. There is also one marked XIX, on which appears an imperator triumphing in a car; this car is placed on the back of a camel; and behind the imperator is a monkey mimicking him.

120 Of the contorniati.

A fourth class of medals are called *contorniati* from the Italian *contorniato*, "encircled;" because of the hollow circle which commonly runs around them. They are distinguished from medallions by their thinness, faint relief, reverses sometimes in relief, sometimes hollow; and in general by the inferiority in their workmanship. The opinions of medallists concerning these pieces are very various; some suppose them to have been struck by Gallienus to the memory of illustrious men and celebrated *athletæ*, at the time that he caused all the consecrated coins of his predecessors to be restored; others ascribe their invention to Greece, &c. but Mr Pinkerton is of opinion that they were only tickets for places at public games. Many of them, notwithstanding their inferior workmanship, are very valuable on account of their preserving the portraits of some illustrious authors of antiquity, no where else to be found. Much dependance, however, cannot be put on the portraits of Greek authors and eminent men found upon some of them; for though we know that the busts of Sallust, Horace, &c. must have been struck when their persons were fresh in the memory of the artists, yet it was otherwise with Homer, Solon, Pythagoras, &c. which are to be found in some of them. Even these, however, are valuable, as being ancient and perhaps traditional portraits of these great men. The last whose portraits are supposed to have been delineated in this way, are Apollonius Tyaneus who flourished in the time of Domitian, and Apuleius in that of Marcus Antoninus. Mr Pinkerton thinks it a confirmation of his opinion concerning these medals, that the reverses always contain some device alluding to public games, as that of a charioteer driving a chariot, &c.

Sect. XII. *Directions for Making Cabinets*

We must now proceed to the last part of our subject, viz. that of giving directions for the formation of cabinets. As we have already seen that the formation of any one must be attended with very considerable expence, it is necessary for every one who attempts this to proportion the cabinet to his own circumstances. There are, properly speaking, three kinds of cabinets. 1. Those meant to contain a coin of every sort that has been issued from the mint in every age and country; but this, which may be called the large and complete cabinet, is not to be purchased by private persons. That of Dr Hunter already mentioned is perhaps one of the best private cabinets ever known; and cost 23,000l. but as many duplicates were sold as cost 2000l. by which means the expence was reduced to 21,000. The vast collection made by the king of France cost upwards of 100,000l. The smaller

Directions for making cabinets.

ſmaller cabinet may be ſuppoſed to conſiſt only of middle and ſmall Roman braſs, Engliſh pennies, groats, &c. with a few medals of the more valuable kind, and may be ſuppoſed to incur an expence of from 200 to 1000l. The ſmalleſt kind is called a *caſket* of medals and does not conſiſt of above a thouſand at moſt of various kinds; and conſequently the expence muſt depend on the pleaſure of the proprietor.

In the formation of the grand cabinet, it muſt be obſerved that the Greek medals of every denomination do not admit of any arrangement by the metals like the Roman; not any regular ſeries of this kind being met with even in the moſt opulent cabinets. Hence in all collections the civic coins are ranged according to an alphabetical order; and the monarchic in a chronological one. The ſame rule is to be obſerved in the Roman conſular medals; they are ranged, like the coins of the Greek cities, in the alphabetical ſeries of the families. The Roman imperial coins are only thoſe capable of being arranged according to ſizes and metals. Even from this muſt be excepted the minimi, or very ſmalleſt coins; which are ſo ſcarce, that the only regular ſeries of them in the world is that belonging to the king of Spain, which was formed by a moſt ſkilful French medalliſt, and conſiſts of all the metals. The arangement of a grand cabinet, according to Mr Pinkerton, is as follows.

"I. The coins of cities and of free ſtates in alphabetical order: whether uſing Greek, Roman, Punic, Etruſcan, or Spaniſh characters.

"II. Kings in chronological ſeries, both as to foundation and ſeniority of reign.

"III. Heroes, heroines, founders of empires, and cities.

"IV. Other illuſtrious perſons.

"V. Roman aſes.

"VI. Coins of families, commonly called conſular.

"VII. Imperial medallions.

"VIII. Imperial gold.

"IX. Imperial *minimi* of all metals.

"X. Imperial ſilver.

"XI. Imperial firſt braſs.

"XII. Second braſs..

"XIII. Third braſs.

"XIV. Colonial coins, which are all of braſs.

"XV. Greek cities under the emperors, of all metals and ſizes. In a ſmaller cabinet they may be put with the Roman, according to their metal and ſize. Thoſe without the emperor's head go to claſs I. though ſtruck in Roman times.

"XVI. Egyptian coins ſtruck under the Roman emperors, of all metals and ſizes. They are moſtly of a baſe metal called by the French *patin*; it is a kind of pot metal or brittle braſs.

"XVII. Contorniati, or ticket medals.

"XVIII. Coins of Gothic princes, &c. inſcribed with Roman characters.

XIX. Coins of ſouthern nations uſing uncommon alphabets; as the Perſian, Punic, Etruſcan, and Spaniſh.

"XX. Coins of northern nations uſing uncommon characters, as the Punic and German.

"In the modern part no ſeries can be formed of copper that will go back above two centuries; but ſequences (chronological ſeries) of gold and ſilver may be arranged of all the different empires, kingdoms, and ſtates, as far as their ſeveral coinages will allow. Thoſe of England and France will be the moſt perfect. Modern ſilver is commonly arranged in three ſequences; the dollar, the groat, and the penny ſizes. The medals of each modern country ought of courſe to be ſeparated; though it is beſt to arrange each ſet in chronological order, let their ſize of metal be what they will. It may be remarked here, that modern medals, of the ſize of a tea-ſaucer, are only ſo many monuments of barbariſm. The ancient medallions are almoſt univerſally but litttle larger than our crown-piece, though three or four of them may extend to about two inches diameter, but very many modern medals to four inches and more. A large medal always declares an ignorant prince or an ignorant artiſt. Into the ſize of a crown-piece the ancients threw more miracles in this way than will ever appear in theſe monſtrous productions."

Theſe directions will likewiſe apply to the formation of a cabinet of the ſecond kind; but if the collector means to form a ſeries of large Roman braſs, he will find the coins of four or five emperors ſo ſcarce as not to be attainable in that ſeries, even at any price. He muſt therefore ſupply their places with middle braſs, as is allowed with regard to Otho; even in the beſt cabinets, there not being above three coins of that emperor in large braſs known in the world: whereas of the middle braſs, two or three hundred may exiſt. For this reaſon Mr Pinkerton concludes, that in cabinets of the ſecond claſs, the collector may mingle the large and ſecond braſs together as he thinks proper, in order to ſave expence; though it would not do ſo well to unite ſuch diſproportionate ſizes as the large and ſmall. "In the ſmall ſequence, however (ſays he), there can be no harm in his mixing gold, ſilver, and braſs, as chance or curioſity may lead him to purchaſe any of theſe metals. And tho' your ſtarched bigotted medalliſt may ſneer becauſe ſuch a ſequence would controvert his formal and narrow way of thinking, common ſenſe will authoriſe us to laugh at the pedant in our turn, and to pronounce ſuch a ſeries more various, rich, and intereſting, than if the collector had arranged only one metal, and rejected a curious article becauſe he did not collect gold or ſilver. In like manner, if, in the modern part of the ſmaller cabinet, any coin of a ſeries is of high price, or of bad impreſſion, there can be no impropriety in putting another of the ſame reign, which is cheaper, or better executed, though of a different denomination or of a little larger ſize. In ſhort, the collector has no rules but in the Greek cities and Roman families, to obſerve alphahetical order and chronology in every thing elſe.

Tables of ancient Coins.

The moſt ancient coins, according to Froelich, are diſtinguiſhed by the following marks, which he accounts infallible. 1. Their oval circumference, and globulous ſwelling ſhape. 2. Antiquity of alphabet. 3. The characters being retrograde, or the firſt diviſion of the legend in the common ſtyle, while the next is retrograde. 4. The indented ſquare already deſcribed. 5. The ſimple ſtructure of the mintage. 6. Some of

Ancient coins.

of the very old coins are hollowed on the reverse, with the image impressed on the front. 7. The dress, symbols, &c. frequently of the rudest design and execution.

TABLE I. *Ancient Greek Coins.*

1. Those without impression.

2. With one or more hollow indented marks on one side, and an impression in relief on the other.—Of Chalcedon on the Hellespont, Lesbos, Abdera, in Thrace, Acanthus in Macedon, those said to belong to Egium in Achaia. This class continues from about 900 to 700 B. C.

3. With an indented square divided into segments, having a small figure in one of them; the rest blank, with a figure in relief on the obverse.—Of Syracuse and other places adjacent.—Continue from 700 to 600 B. C.

4. Coins hollow on the reverse, with figures in relief on the obverse.—Of Caulonia, Crotona, Metapontum, &c. Supposed by some to be a local coinage of Magna Græcia; but probably of equal antiquity with the former.

5. Coins in which a square dye is used on one or both sides.—Of Athens, Cyrene, Argos, &c.—Of Alexander I. and Archelaus I. of Macedon. Disused in the reign of the latter about 420 B. C.

6. Complete coins, both in obverse and reverse, occur first in Sicily in the time of Gelo, about 491 B. C.

7. Coins of Alexander the Great and his successors. About the time of this hero the Greek coins began to attain to perfection, and were struck of uncommon beauty. It is remarkable, that on the coins of this monarch his own image seldom occurs. The only one yet found of Alexander with his portrait upon it, and struck during his reign, is a silver hemidrachm in Dr Hunter's cabinet, which is represented Plate CCXCII. n° 3. After his death many coins bear his portrait. Trebellius Pollio informs us, that some coins, particularly those of Alexander, used to be worn as amulets; and many medals are met with in cabinets bored seemingly with that intention.

8. Coins of the successors of Alexander.—Those of the Syrian monarchs almost equal the coins of Alexander himself in beauty. Those of Antiochus VI. are supposed to be the most perfect patterns of male-beauty to be met with any where. The Egyptian Ptolemies are somewhat inferior.

9. The coins of the Arsacidæ of Parthia done by Greek workmen.

10. The Greek imperial coins, being such as have the head of an emperor or empress: such as have not these impressions being classed with the civic coins, though struck under the Roman power. None of the imperial coins occur in gold. Of silver there are those of Antioch, Tyre, Sidon, Tarsus, Berytus, Cæsarea. Egyptian silver coins of base metal. Syrian silver coins, which sometimes bear on the reverse the club of Hercules, or the Tyrian shell-fish. Those of Sidon bear the image of the goddess Astarte, or her chariot. Those of Cæsarea in Cappadocia of better work than the Syrian. Lycian coins of good workmanship; on the reverse two harps and an owl sitting upon them. Silver coins of Gelon in Sarmatia resembling the Syrian. The situation of this town is very much unknown. It seems to have been situated on the north of the Euxine sea where some Sarmatic or Sclavonic tribes were mingled with the Scythians or Goths. The Greek imperial brass coins are very numerous. A series of almost all the emperors may be had from those of Antioch, with a Latin legend on the obverse and Greek on the reverse. Those of Bithynia and Phrygia remarkable for good workmanship. The coins of Tarsus remarkable for their curious views of objects, almost in perspective. The Egyptian coins, from the time of Augustus to Nero are worse executed than afterwards. From Nero to Commodus they are frequently of admirable workmanship, and in a peculiar style distinct both from the Greek and Roman. From the time of Commodns they decline, and are lost after the reign of Constantius I. The Egyptian brass coins of the Roman period are likewise of excellent workmanship, especially in the time of Antoninus Pius.

TABLE II. *Roman Coins.*

I. The consular coins, called also the coins of families, and arranged alphabetically in cabinets, according to the names of the families which appear on them. They are,

1. *Brass coins.*—These consist chiefly of large pieces of rude workmanship without any interesting imagery. In cabinets they are generally kept in boxes apart by themselves. The as bears the head of Janus; the semis of Jupiter with S; the triens of Minerva with four ciphers; the quadrans of Hercules with three ciphers; the sextans of Mercury with two ciphers; and the uncia bears the head of Rome with one cipher. In all these pieces the prow of a ship is constantly the figure on the reverse, with very few exceptions. Sometimes, indeed, they have a shell, two heads of barley, a frog, an anchor, or a dog, on the reverse. About the time of Julius Cæsar both the obverses and the reverses of the coins began to be altered.

2. *Silver.* Of this the denarius was the first and principal coin. It was stamped originally with X, denoting that the value was ten ases. On the reverse was Castor and Pollux, or a chariot of victory. Afterwards the busts of various deities make their appearance; and in the seventh century of Rome the portraits of illustrious persons deceased are met with: but till the time of Julius Cæsar no figure of any living person is to be met with; Julius himself being the first who assumed that honour. The workmanship on the best and worst silver is much the same. The reverses are very curious, and point out many remarkable events in Roman history; but none of these occur till about a century before the christian era. The large denarii, with ROMA, are the most ancient; and some of these bear the Pelasgic A, not the Roman. The silver sestertii have a head of Mercury, with a caduceus on the reverse. The quinarii have always a head of Jupiter, with a victory on the reverse

3. *Gold.*—Most of these are of great value. The number of these exceeds not 100; those of brass 200; and of silver 2000. The aureus is the general gold coin; but two or three gold semisses of families likewise occur.

Ancient coins.

II. Roman imperial coins.

1. *Brass.*—This is of three sizes, large, middle, and small. The first forms a most beautiful series, but very expensive. The various colours of the platina have the finest effect. It is the most important of all the Roman coins, and exceeds even the gold in value.

The middle brass is next in value to the former; and in it are many rare and curious coins, particularly interesting to Britons, as elucidating the history of the island. Of these are the triumphal arch of Claudius; the EXERC. BRITANNICUS of Adrian; the coins of Antoninus Pius, Commodus, Severus, with a Victory, VICTORIA BRITAN.: but especially those personifying the country BRITANNIA. "The number of Roman coins relating to Britain (says Mr Pinkerton) is remarkable, more than 20 having been struck at various times; while those personifying Italy, Gaul, Spain, and other regions of the empire, exceed not four or six at most for each country. Only one country vies with Britain, and that is Dacia on the extreme north-east of the empire, as Britain on the extreme north-west. No doubt this circumstance of remoteness in these two countries recommended them to this particular attention, as more expressive of the Roman power.

The small brass series abounds also with curious coins. They are scarce till the time of Valerian and Gallienus, but very common afterwards. Mr Pinkerton recommends, therefore, to form a series in silver as well as brass; both being the cheapest of all the Roman coins. "In this series (says he), it is a common fault to arrange many coins which have been plated with gold or silver, the forgeries of ancient times, but which time has worn off either wholly or in part. All real brass coins have the s. c. till the time of Gallienus; as the senate alone had the power of striking brass, while the emperor himself had that of gold and silver. When the s. c. therefore, is wanting, the coin was certainly once plated; as, in general, the different type and fabric, being those of gold and silver, sufficiently show themselves. With Pertinax, A. D. 192, there is a temporary cessation of small brass; nor after him do any princes occur in that series till Valerian, A. D. 254, excepting Trajanus Decius, A. D. 250 only. After Valerian the series is continuous and common. The brass coinage gradually declined in size from the time of Severus; so that parts of the as could not be struck, or at least it was held unnecessary to strike them. Trajanus Decius attempted in vain to restore the coinage; and Valerian and Gallienus were forced to issue denarii ærei and small assaria. The series of large and of middle brass are of two fixed and known sizes; the former about that of the crown, the latter of the half crown: though after Severus they gradually lessen. But the small brass takes in all parts of the as; and every brass coin not larger than a shilling belongs to this series. The *minimi*, indeed, or very smallest, it is proper to keep apart. The coins of Julius Cæsar in this size are of peculiar fine workmanship. They bear his portrait reverse of Augustus or the reverse has a crocodile EGYPTO CAPTA. There are several with Mark Anthony, and some with Cleopatra; but the more common pieces are those with only numerals on the obverse, which go the length of XIII; probably tickets for the baths. A great many occur in the time of Nero; of which Mr Pinkerton particularises one which has "on the reverse a table ornamented with griffins and other devices. Upon it is placed a wreath of laurel; and a beautiful vase, of which the embossed human figures are so minute, and finished so surprisingly, as to stamp these coins the most exquisite productions of the ancient mint." From the time of Nero to that of Vespasian no small brass occurs; but there are many of this emperor and of his son Titus; while Domitian has as many as Nero, and Domitia his wife has almost as many. Succeeding emperors to the time of Pertinax have also many brass coins; but from his time to that of Valerian there are no real small brass, excepting those of Trajanus Decius. After Gallienus there are a great many coins of this kind; and Mr Pinkerton mentions one in Dr Hunter's cabinet, of an unknown person named Nigrianus. The coin seems to have been struck at Carthage; and our author concludes that he was an African Usurper, father to Nigrinianus.

2. *Silver.*—This series is very complete, and the cheapest of any; especially as the small brass becomes a fine supplement to it; the latter being had in plenty when the silver becomes scarce, and the silver being plentiful when the brass was scarce.

3. *Gold.*—The Roman imperial gold coins form a series of great beauty and perfection; but on account of their great price are beyond the purchase of private persons.

4. *The colonial coins* occur only in brass, none, excepting that of Nemausus, having a right to coin silver. They begin in Spain with Julius Cæsar and Anthony, and cease with Caligula, who took away the privilege of coinage from the Spanish colonies. The most beautiful are those of Corinth. The other remarkable colonial coins are those of Emerita, Ilice, Terraco, Cassandria, Babba, Berytus, Cæsarea, Patræ, Emisa, Heliopolis, or Balbec, Ptolemais, Sidon, Tyre, Deulton, Dium, Troas, Rhesaina, Neapolis of Samaria, which bears a representation of Mount Gerizzim with the temple on it, Hippo in Africa, &c. On many of these coins we meet with fine representations of temples, triumphal arches, gods, goddesses, and illustrious persons. But coins with those representations are by no means common; the colonial coins till the time of Trajan bearing only a plough, or some other simple badge of a colony. Camelodunum is the only colony in Britain of which we have any coins.

5. The *minimi.*—This includes the smallest coins of all denominations most of which do not exceed the size of a silver penny. They are the most curious of all: but no series of them was ever formed by any person except the abbe Rothelin, whose collection formed of all metals passed to the queen of Spain. The reason of the scarcity of these small coins is probably their diminutive size; by reason of which they are mostly lost.

It is surprising that numbers of Roman coins are found through all countries once subject to that powerful people. Some have been met with in the Orkneys,

Ancient Coins.

neys, and many in the moſt remote parts of Europe, Aſia, and Africa, known to the ancients.

TABLE III. *Coins of other ancient Nations.*

1. The Lydians appear to have invented coinage; though, perhaps, this honour may be diſputed with them by the Greeks.

2. The Aſſyrians, Medes, Babylonians, Phenicians, and Egyptians, had no coins. In the mouths of the mummies are only thin, unſtamped, and round pieces of gold to pay Charon's fare.

3. No Indian or Chineſe coins are to be met with till a very late period; and even then ſo rude as ſcarce to be worth notice. Voltaire mentions a collection of ancient Chineſe and Indian coins made by the emperor of China in 1700; but Mr Pinkerton ſuppoſes it to have conſiſted only of the Greek and Roman money which had been introduced into theſe countries.

4. The Lydian coins have no legends; ſo that mere conjecture only determines the ancient coins of electrum and ſilver found in Aſia, and different from the Perſian, to belong to Lydia. Crœſus coined gold into a form which he called *ſtaters*; and Mr Pinkerton mentions a very ancient gold coin in Dr Hunter's cabinet, which he ſuppoſes to have been one of theſe. It has a globous figure, with indented marks on one ſide, and on the other a man kneeling, with a fiſh held out in the left hand, and a ſword depending in the right. It weighs four drams; which Joſephus tells us was the weight of the Lydian gold coins. In the ſame collection are other gold coins little inferior in antiquity; the moſt ancient of which, our author ſuppoſes, may have been coined by the cities of Aſia Minor, as coinage paſſed through them to Greece. They are of admirable workmanſhip, and as much ſuperior to the beſt Sicilian coins, as the latter are to all the reſt in the world. Theſe gold coins are all extremely pale; owing to the want of knowledge in refining gold.

5. Perſian coins.—Theſe were firſt ſtruck by Darius Hyſtaſpes, whence they had the name of *Darics*. They are of gold, and generally have the figure of an archer: they weigh about four drachms; and ſome occur with the indented mark on one ſide, while others have figures upon both. The ſilver coins have generally a king in a chariot of two horſes, with a charioteer, and ſometimes another figure on foot behind on the obverſe; while the reverſe preſents a ſhip, ſometimes a ram, bull, or other animal. The gold coins, which only had the title of *Darics*, are extremely ſcarce, having been melted down, as is ſuppoſed, and recoined by Alexander the Great on his conqueſt of Aſia.

There is a ſecond ſeries of Perſian coins beginning with Artaxares, or Artaxerxes, who overthrew the Parthian monarchy about the year 210. Theſe are large and thin, with the king's buſt on one ſide and the altar of Mithras on the other; generally with a human figure on each ſide. Theſe coins continue till the year 636, when Perſia was conquered by the Saracens. Theſe have only Perſian letters upon them, which have never been explained by any antiquaries. Mr Pinkerton ſays that they ſeem to partake of the ancient Greek, Gothic, and Alanic.

6. The Hebrew ſhekels, originally didrachms, but after the time of the Maccabees tetradrachms, are almoſt all forgeries of modern Jews, as well as the braſs coins with Samaritan characters upon them. They have all a ſprig upon one ſide and a vaſe on the other. Mr Pinkerton ſays, that the admiſſion of one of them into a cabinet would almoſt be a diſgrace to it.

7. Phœnician and Punic coins are very intereſting on account of the great power and wealth of theſe nations. The alphabets have been cleared by their relation to the Hebrew and Syriac languages.

8. The coins of Palmyra come under the ſame denomination with the former, Palmyra being a Syrian city.

9. The Etruſcan coins have the characters of that nation, which have been explained by their affinity to the Pelaſgic, or oldeſt Greek and Latin.

10. The Spaniſh coins are inſcribed with two or three alphabets allied to the old Greek or Punic; but the inſcriptions have not been ſufficiently explained.

11. Gauliſh coins.—Theſe are numerous; but the moſt ancient have no legends; and even after the Greek letters were introduced into Gaul by a colony at Marſeilles, the legends are very difficult to be explained.

12. Britiſh coins. From a paſſage in Cæſar's commentaries, it has been inferred that the Britons uſed ſome kind of coins even in his time. Mr Pinkerton informs us, that ſome rude coins of copper very much mingled with tin are frequently found in England; which, he ſuppoſes, may be ſome of the ancient Britiſh money. They are of the ſize of a didrachm, the common form of the nummus aureus among the ancients. After the time of Cæſar, coinage increaſed among the Britons; and there are many found of Cunobelinus mentioned in the Roman hiſtory. Moſt of theſe have on one ſide CUNO, with an ear of wheat, a horſe, a kind of head of Janus, or other ſymbol; and have frequently alſo the letters CAMU; ſuppoſed to mean Camelodunum. Sometimes the word TASCIA occurs; the meaning of which has not yet been explained.

13. Gothic coins of France, Italy, and Spain, to the time of Charles the Great. Theſe have the Roman characters upon them. The Italian coins are moſtly of the ſize of ſmall braſs; and in this way we meet with coins of Athalaric, Theodohat, Witigez and other Gothic princes. Many others occur, the inſcriptions of which, though meant for Roman, are ſo perverted as to be illegible.

TABLE IV. *Modern Coins.*

1. Of Japan.—Theſe are thin plates of gold and ſilver, of an oval figure, with ſmall marks or figures ſtamped on them.

2. China.—Theſe are only copper, about the ſize of a farthing, with a ſquare hole in the middle to put them on ſtrings. The inſcriptions on them do not expreſs the name of the ſovereign, but the year of his reign; as the *happy year*, the *illuſtrious year*, &c.

3. The tartarian coins are rude, having only inſcriptions upon them; and they are all poſterior to the time of Jenghiz khan.

4. Coins of Thibet, Pegu, and Siam, are much the

ſame,

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same, presenting only inscriptions without any figures. They are also of late date.

5. India.—Some old coins have been found in the neighbourhood of Calcutta, of gold, silver, copper, and tin, all mixed together. These have commonly a warrior with a sword on one side and an Indian female idol on the other, of the same form with the celebrated sculptures in the island of Elephanta; but it is impossible to tell what antiquity they are of. The modern coins are the pagoda of gold, worth little more than six shillings; the roupee of silver upwards of two shillings; and the cash, of copper. There is a remarkable set of roupees, which show the twelve signs; a lion on one, a bull on another, &c. but the occasion on which they were struck is unknown. The other coins of India have generally Persian inscriptions upon them.

6. Persia.—The Persic coins since its conquest by the Arabs continue on the Arabian model.

7. Arabia.—Some coins of the petty princes of Arabia are met with as old as the imperial ages of Rome; but till the time of Haroun Alrashid, no regular coinage appears in the vast empire of the Saracens. Even then the reverse has only an inscription, and the obverse is copied from any Greek or Syrian coin which happened to fall in the moneyer's way. The later Arabian coins are mostly silver, with the name and titles of the prince on one side, and some inscription from the Koran on the other. The more modern coins of this country are in the shape of a fish-hook, with Arabic inscriptions.

8. Turkey.—No regular coinage was formed by the Turks till they became masters of Constantinople. They resemble those of Persia and Arabia, having merely inscriptions on both sides.

9. The coins of the African states, at least such as profess the Mohammedan religion, have merely inscriptions without any figures: those of the internal parts are unknown; and no coinage was used among the Mexicans and Peruvians, the only civilized nations in America; but La Hontan mentions an American savage who had a square medal of copper depending from his neck. Mr Pinkerton supposes it to have come from Japan.

10. Modern Italic coins. Besides the Gothic princes mentioned in the former table, the exarchs of Ravenna coined money with the inscription FELIX RAVENNA, &c. The Lombards issued no coins, but there are some still extant of Charlemagne. The following list shows the origin of the coinage in various Italian states.

Rome. Papal coinage originates with Hadrian I. Size of silver pennies, with the Pope's name on one side, and SCOS PETRUS on the other. No coins appear from 975 to 1099, excepting of Leo IX. In 1303 appear pennies of the senate and people of Rome, with Peter on the one side and Paul on the other. There are groats of Clement V. with his portrait three quarters length; but the side-head begins with Sixtus V. in 1470. Gold was first coined by John XXII. in 1316. The coins of Alexander VI. Julius II. and Leo X. are remarkable for beauty and elegance.

Milan. Coinage began with Charlemagne. The first coin of the family of Visconti occurs in 1330 under Azo. The set finishes with Louis XII.

Naples. Coinage begins in 840 and 880, with Duke Sergius and Bishop Athanasius. The next coins are of Roger of Sicily, and Roger II. in 1130, William I. II. and Tancred. Naples and Sicily were subdued in 1194 by the emperor of Germany: in 1255 Manfred appears; in 1266 Charles of Provence; and others till Joan in 1414: after which follow the house of Arragon, and later kings.

Venice begins in the 10th century. The first coins are silver pennies marked VENECI. Then follow the coins of Henrico Dandulo in 1192, of Ziani in 1205, &c. Gold was first coined at Venice in 1280, and copper in 1471; but the silver groats are as old as 1192.

Florence. Silver was coined here in the 12th century, or before; but in 1252 the first gold coins struck in Europe after the 8th century made their appearance, and were named *florins* from the flower of the lily upon them. They were imitated by the popes, by France, and England. They have on one side St John the Baptist standing, on the other a large *fleur de lis*, and it is not doubted that the French *fleurs de lis* took their origin from these coins. They weigh a drachm, and are no less than 24 carats fine according to Italian writers, and are worth about 12 shillings Sterling.

Geneva first began to coin money in 1129, under the government of Conrad. Those of the dukes of Savoy began in the same century.

Aquileia. Coins were issued from this city by the patriarchs from 1204 to 1440.

Ferrara. Coins of the marquises from 1340.

11. French coins. During the race of Clovis, from 490 till 751, the coins are chiefly gold *trientes*, with some *solidi* and *semisses*. The former are of good workmanship, with the heads of kings. The reverse has a cross, with the name of the town where they were struck.

The coins of the second race begin with Pepin in 751, and continue till Hugh Capet in 987. The coins of the first race are elegant, but those of the second entirely the reverse, being almost all silver pennies, and seldom bearing the portrait of the king. Those of Charlemagne have only CAROLUS in the field; while the reverse bears R. F. or some such inscription; though one piece struck at Rome has a rude bust of him. The coins of Louis le Debonnaire are better done.

The third race begins with Hugh Capet in 987, and extends to this time. The coinage did not begin to improve till 1226 under St Louis, when the groat appears. Its name in Italian is *grosso*, in French *gros*, in English *groat*, or great coin; so called from its size in comparison with the penny; and it passed from Italy to France, to Germany, and to England. After the conquest of France by the English, base coins of many kinds were introduced; and in the year 1574, in the time of Henry III. copper was first introduced into the French coinage. Besides these, the other remarkable coins of France are, the blancs or billon groats, first issued in 1348; the *ecus a la couronne*, or crowns of gold, so called from the crown on one side, and

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and begun by Charles VI. in 1384: those of Ann of Bretagne in 1498: the *teston*, or piece with the king's head, of Louis XII.; the *Henri* of Henry II. with Gaul sitting in armour, and a Victory in her hand. There are many coins of cardinal Bourbon, elected king in 1589; and in 1642, Louis XIV. takes the title of CATALONIÆ PRINCEPS. The first *Louis d'Or* made its appearance in 1640; but such was the poverty of France, if we believe certain authors, that in 1719 the duke of Orleans regent struck copper for silver.

12. Spanish coins. The most early series of these consists almost entirely of trientes, finely done. On one side they have the head of the king with his name, and on the other a cross, with the name of the town, commonly in Bœtica, or the south part of Spain, where there were a great many Roman colonies, and which was fertile to a proverb. The Moresque coins of Spain, like those of the rest of the Mohammedan states, present us only with insipid inscriptions on both sides. Indeed the Mohammedan religion, by its absolute refusal to allow the representation of any living creature, has prevented the progress of coinage in any degree throughout those regions which it has overspread. The inscriptions on the ancient Spanish coins are in the Cufic or old Arabic characters.

13. Portugal. No description of the coins of this kingdom has yet appeared.

14. Germany. No account of the German coins has been published; though it is well known that not only the emperors, but many of the cities, particularly those called *Hanse-towns*, issued money; and many of the coins issued by the cities were superior in elegance even to those issued by the emperors.

15. Denmark. Here the coinage begins with Canute the Great in 1014. The pieces are at first extremely rude, ornamented only with rings and runic characters. These are succeeded by copper pieces, some of which have a cross, others a pastoral staff on one side, with the letter A on the other. Later coins have strokes 1111, &c. all round them; but those of Harold, Hardicanute, and Magnus Bonus, in 1041, are of neat workmanship, and have the portraits of the princes at half length. The coins of Nicolas or Niel, as he is called by the Danes, are rude, as well as those of Waldemar I. and the celebrated Margaret. In 1376 Olaf caused money to be struck with a grinning full face, with a crowned O upon the other side. "The Swedes (says Mr Pinkerton) took these coins extremely ill, as they thought they grinned at them." Silver was first coined in Denmark by Philippa queen of Eric, and daughter to Henry IV. of England.

16. Sweden. The coinage of this kingdom began in 818 under Biorno, on the plan of Charlemagne. The coins are marked with a cross. Next follow those of Olaf in 1019; which Mr Pinkerton supposes to have been the first true Swedish coins; and that the art of coinage first passed from England into Denmark in the time of Canute the Great, and from Denmark into Sweden. These coins were struck on the English model. During the time that Sweden was subject to Denmark, or miserably harassed by the Danes, the coins of both kingdoms were the same but after the time of Gustavus Vasa many elegant pieces appear. In 1634, dollars were coined with the portrait of Gustavus Adolphus, who was killed two years before: On the reverse they have the arms of Sweden, with the chemical marks of mercury and sulphur. In 1716, 1717, and 1718, Charles XII. being in extreme want of money, issued small copper coins with Saturn, Jupiter, Mars, &c. upon them, to go for dollars; and on account of this scheme, Baron Goertz, the suggestor of it, was brought to the block.

17. Norway. The coins of this country begin with Olaf 1006; after which time there are various coins of other princes; but copper was not coined till the year 1343.

Besides the coins already mentioned, there are ecclesiastical coins of France, Germany, Denmark, Sweden, Norway, &c. Those of Denmark and Sweden are numerous, but the Norwegian coins of this denomination are rare. Mr Pinkerton describes a silver one in his possession as having arms and a mitre, with the inscription on one side SANCTUS OLAWS REX NORVEY; on the reverse OLAWS DEI GRA. ARCEP. NID'SEN, meaning NIDROSIENSIS, or archbishop of *Nidros*, now Drontheim.

18. Bohemia. The coinage of this kingdom appears at a very early date, viz. in the year 909, under duke Boleslaus I. These coins are followed by others of Boleslaus II. and Emma his wife in 970; of Boleslaus III. in 1002; Jaromir in 1020; Udalrich in 1030, and other princes. The *bracteate* money of Ottocar I. was coined in 1197.

19. Poland. The coinage of this country is nearly as ancient as that of Bohemia. The coins are on the German model, but no particular account of them has been published.

20. Russia. None of the Russian money appears to be more ancient than the 13th century. The first are the *kopecks* or silver pennies, which have upon them rude figures of animals upon one side, and a man standing with a bow or spear on the other. There are likewise coins of Moscow struck by Aristoteles the architect in 1482. The *roubles* or dollars and their halfs. There are some of the impostor Demetrius in 1605, which are very scarce.

21. Prussia. The first Prussian coins were struck at Culm by the Teutonic knights in 1230. They were silver pennies, and upon the German plan. In the next century were struck shillings, groats, and *schots*; the last were the the largest, and are extremely rare. They have the Prussian shield, an eagle surmounting a cross, with a rose-shaped border, MONETA DOMINORUM PRUSSIÆ; on the reverse is a cross fleurie, within a border of a similar kind, having the inscription HONOR MAGISTRI, JUSTITIAM DILIGIT.—Gold coins were struck in the same century. In the time of Copernicus the money was so debased, that 12 or 13 marks were worth but one of pure silver.

22. England. The English coins are of various kinds.

1st. *Heptarchic*. These are only of two sorts, viz. the *skeatta* or penny of silver, and the *styca* of copper. Few of the pennies appear till after the year 700; though some are met with which bear the name of Ethelbert I. king of Kent, as old as 560. At first they had only rude figures of serpents but in latter times

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times legends were likewise added. Most of these pennies have pagan symbols upon them. The styca was only coined in Northumberland, and was a very small piece about the value of half a farthing.

2d. Coins of the *chief monarchs* of England. Mr Pinkerton denies that an end was put to the heptarchy by Egbert in 832, as is commonly supposed; though he owns that he was *chief monarch* of the country, as several others had been before him. Edgar, who reigned in 959, according to him was the first king of England; and the coins of the chief monarchs form almost a complete series from the time of Egbert to Edgar. The only chief monarch of whom there are no coins is Ethelbald, who reigned in 857. Most of these coins bear rude portraits; but the reverses are sometimes curious and interesting. Some have views of cathedrals and other buildings; particularly one of Edward the Elder in 900; which has the cathedral of York with three rows of windows, round arched as the other Saxon and Norman buildings; the Gothic arch being quite unknown till after the 12th century. Some coins of Anlaf king of Northumberland have the famous raven, the Danish ensign; and those of other princes have frequently very curious reverses.

3d. *Ecclesiastic* coins appear of the archbishops of Canterbury, Wulfred, in 804, Ceolnoth in 830, and Plegmund in 189.

4th. Coins of the *kings* of England. The silver penny, which had begun during the heptarchy, continued to be the general coin after the kingdom had been united under one head; and extends in a continued series from Egbert almost to the present reign. The only kings wanting are Edmund Ironside, Richard I. and John. At first the penny weighed 22½ grains; but towards the close of the reign of Edward III. it fell to 18 grains; and in that of Edward IV. to 12. In the time of Edward VI. it was diminished to eight grains; and in Queen Elizabeth's reign to 7$\frac{23}{31}$; at which it still continues.

Halfpennies and farthings were first struck in silver by Edward I. in 1280; the former continued to the time of the commonwealth, but the latter ceased with Edward VI. The groat was introduced by Edward III. in 1354, and continues to this day, though not in common circulation. The half-groat or twopence is of the same date, and also continues to the present time.

Shillings were first coined by Henry VII. in 1503. At first it was called *testoon*, from the *teste*, *tete*, or head of the king upon it; the name *shilling* being derived from the German *schelling*; under which appellation coins had been struck at Hamburgh in 1407. The crown was first coined in its present form by Henry VIII. Formerly it had appeared only in gold, whence the phrase of crowns of gold; though these indeed were the largest gold coins known for a long time in France and other countries on the continent, being worth about 10s. sterling. They had their name from the crown stamped on one side, and were first coined by Charles VI. in 1384, and continued till the time of Louis XIV. The half-crown, sixpence, and threepence, were coined by Edward VI. In 1558 Queen Elizabeth coined three halfpenny, and in 1561 three farthing, pieces; but they were discontinued in 1582. From the year 1601 to the present time the coins of England remain the same.

Gold was coined in England by Henry III. in 1257; the piece was called a *gold penny*, and was larger than the silver one; and the execution is by no means bad for the time. The series of gold coinage, however, commences properly from Edward III. In 1344 this monarch first struck florins, in imitation of those in Italy; and it is remarkable, that though these coins at the time they were first issued bore only six shillings value, they are now intrinsically worth 19s.; so much has the value of gold increased since that time. The half and quarter florin were struck at the same time, but only the last has been found. The florin, however, being found inconvenient, gave place to the noble of 6s. 8d. value, and exactly half a mark. The latter had its name from being a limited sum in accounts; and was eight ounces in weight, two-thirds of the money pound. It is sometimes also called *selibra*, as being one half of the commercial pound of 16 ounces. The noble had its name from the nobility of the metal; the gold of which it was coined being of the finest sort. Sometimes it is called *Rose Noble*, from both sides being impaled in an undulating circle. It continued with the half and quarter noble to be the only gold coin till the angels of Edward IV. appeared in 1465. These had their name from being stamped with the image of Michael and the dragon. The angelites of 3s. 4d. value were substituted in their place. In 1527 Henry VIII. added to the gold coins the crown and half-crown at their present value; and the same year he gave *sovereigns* of 22s. 6d. and *ryals* of 11s. 3d. angels at 7s. 6d. and nobles at their old value of 6s. 8d. In 1546 he caused sovereigns to be coined of the value of 20s. and half sovereigns in proportion. His gold coin is about the size of the shilling, and the half-crown of sixpence, but thin. All his coins, however gold as well as silver, are much debased; and it was not without much labour and trouble that Edward VI. brought it back to its former standard. On the union of the two crowns, James gave the sovereign the name of *unite*; the value continuing of 20s. as before. He coined also rose-ryals of 30s. value spur-ryals of 15s. angels of 10s. and angelets of 5s. Under the commonwealth, the sovereign got the name of the *twenty-shilling* piece, and continued current till the coinage of guineas. These were so called from their being coined of Guinea gold, and were at first only to go for 20s. though by an universal but tacit consent they always passed for 21s. Half-guineas, double guineas, and five guinea pieces, were also coined during the same reign; which still continue, though the two latter are not in common circulation. Quarter guineas were coined by George I. and likewise by his present majesty; but they were found so troublesome on account of their small size, that they were stopped within a year or two when received at the bank of England; and thus are not to be met with at present. A few pieces of 7s. value have likewise been coined, and are known by the lion above the helmet; but none have been issued. In 1688 the guinea rose to 21s. 6d. and continued to increase in value till 1696, when it was as high as 30s.; but after the recoinage in 1697 and 1698 it fell by degrees, and in 1717 was at its old standard of 21s. and at that time silver

was

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was fixed at its present standard value, viz. as 1 to 15½ in weight.

Though the first money coined in Britain, as we have already observed, was copper, yet, excepting the Northumbrian stycas, no copper coin was found in England from the time of the Saxon conquest till the year 1672. An aversion to a copper coinage it seems was prevalent throughout the nation; and Queen Elizabeth, who without hesitation used base money for Ireland, yet scrupled at coining copper for England. This want of small coin occasioned such an increase of private tokens for halfpennies and farthings, that it became a serious object to government; and in 1594 a copper coinage was seriously thought of. This year a small copper coin was struck about the size of a silver twopence, with the queen's monogram on one side, and a rose on the other; the running legend on both sides being THE PLEDGE OF A HALFPENNY. Of this there are patterns both in copper and silver, but both of them soon fell into disuse. On the 19th of May 1613, King James by royal proclamation issued farthing tokens. They are generally of the same size with the two pence, with two scepters in saltier surmounted with a crown, and the harp upon the other; with an intention, as it would seem, that if they were refused in England they might pass in Ireland. In 1635 Charles I. coined those with the rose instead of the harp; but the circulation of these was entirely stopped by the vast number of counterfeits which appeared, and by the king's death in 1648. After this the private tokens began again to circulate, till put a stop to by the coinage of farthings in 1672. The workmanship of the tokens is quite contemptible. In 1672 the halfpence as well as the farthings which had been struck two years before began to circulate. They were of pure Swedish copper, the dyes engraved by Roettier; and they continued till the year 1684, when some disputes arose about the copper lately obtained from the English mines. Tin farthings were coined with a stud of copper in the centre, and inscribed round the edge as the crown pieces, with NUMMORUM FAMULUS, 1685 or 1686. In 1685 halfpence of the same kind were coined; and the tin coinage continued till the year 1692, to the value of more than L. 65,000; but next year the tin was all called in by government, and the copper coinage recommenced. The farthings of Queen Anne are all trial pieces excepting those of 1714, the last year of her reign. "They are (says Mr Pinkerton) of exquisite workmanship, exceeding most copper coins either ancient or modern, and will do honour to the engraver Mr Croker to the end of time. The one, whose reverse is Peace in a car, PAX MISSA PER ORBEM, is the most esteemed; and next to it the BRITANNIA under a portal. The other halfpence and farthings are less valuable.

23. Scotland. Silver pennies of Alexander I. who reigned in 1107, are believed to exist; and there certainly are some of Alexander II. in 1214. There are likewise coins of David in 1124: but perhaps none of Malcolm IV. his successor, whose reign was very short. There are many coins of William I. in 1165; and a large hoard of his pennies was found at Inverness in 1780.

The money of Scotland continued to be of the same value with that of England till the country was drained by the vast ransom of David II. after which it became necessary to reduce its size; and so much did this diminution affect England, that Edward III. found himself obliged to lessen the English coin also. The diminution of the Scottish coin, however, continued still to go on until it became impracticable to keep par with that of England. In the first year of Robert III. it passed only for one half its nominal value in England; in 1393, Richard II. ordered it only to go for the weight of the genuine metal it contained. In 1600 it had sunk to such a degree as to pass only for a twelfth part of the English money, and continued at that low ebb till the coinage of Scotland was entirely cancelled by the Union of the two kingdoms.

Of silver coins we have only pennies till the year 1293, when Edward I. having coined halfpence and farthings, Alexander III. of Scotland coined also halfpence, of which we have a few, but no farthings are to be met with; but there are silver farthings of Robert I. and David II. The latter introduced the groat and half-groat, which completed the set of Scottish silver. It continued unaltered till the time of Queen Mary, when they all ceased to be coined in silver, on account of the high price of that metal. In 1553 shillings were first coined with the bust of the queen on one side and the arms of France and Scotland on the other. The silver crown was first coined in 1565, which went for 30 s. Scots; lesser pieces of 20 s. and 10 s. having likewise been struck, and marks of silver, worth 3 s. 4 d. English were also coined about the same time. These coins have upon them the marks xxx. xx. x. to denote their value. They are commonly called Cruikstone dollars, from the palm tree upon them, mistaken for a remarkable yew at Cruikstone near Glasgow, where Henry Darnley resided. It is described, however, in the act as a palm, with a "shell-padoc" (a tortoise) crawling up. This alludes to Darnley's marriage with the queen, as the motto from Propertius DAT GLORIA VIRES also implies. The motto NEMO ME IMPUNE LACESSET first appears on the Scottish coins in 1578, and the invention is given to the celebrated Buchanan. In 1582, the crown of an ounce weight went for 40 s. Scots, and was accordingly marked XL.; in 1597 the mark was L. the Scottish money being then only one-tenth of the English: the mark was LX in 1601, the value being then reduced to one twelfth, at which it has ever since continued. In the time of Charles I. half marks, 40 and 20 penny-pieces, were coined. In 1675 the Scottish dollars first appeared, in value 56 s. Scots, with halves and quarters of proportional value. In 1686, James VII. coined 60, 40, 20, 10, and 5 s. pieces; but only those of 40 and 10 s. are known, with these numbers under the bust. At the Union of the kingdoms, all the Scottish coins were called in, and recoined at Edinburgh, with the mark E under the bust to distinguish it; since which there has been no coinage in Scotland. The Scottish silver coins are in general equal, if not superior, in the workmanship to the English.

Gold was first issued by Robert II. about 30 years after Edward III. of England had coined the same metal in that country. The pieces were at first called St Andrew's from the figure of that tutelar Saint upon

Modern coins.

upon the crofs, and who appears on the obverfe with the arms of Scotland, and on the reverfe a lion in a fhield. The lion was another name for the largeft gold coin in Scotland, from the arms of the kingdom upon it. The next was the unicorn, under James III.; which were followed by the bonnet-pieces of James V. Thefe laft are of admirable workmanfhip, being almoft equal to the ancient coins in this refpect. In imitation of the French, the monarch we fpeak of diminifhed the fize of the coin without leffening its weight, an improvement not adopted by the Englifh for a whole century. The laft gold coined in Scotland was the piftole and half piftole, of twelve and fix pounds Scots. Thefe coins have the fun under the head. The gold coins of Scotland fell in the fame proportion with the filver

The copper coinage of Scotland is of more early date than that of England. It was preceeded by money of *billon*, or copper wafhed with filver, called black money. James III. firft coined black farthings in 1466; and this is recorded by hiftorians as one of his greateft faults. This kind of coinage, however, continued as late as the reign of James VI. In his time the true copper coinage began; but as the value of Scottifh money was now declined almoft to the utmoft, the pieces fuddenly affumed a form almoft refembling that of the French coins. The *bodle*, fo called from Bothwell the mintmafter, being equal in fize to the *liard*, and worth two pennies Scottifh, was ftruck. The billon coin, formerly called *bas-piece*, and worth fix pennies Scots, was now coined in copper, and termed the *baw-bee*. Thus it correfponded with the French half fol and Englifh halfpenny, the Scots penny being now equivalent to the French *denier*. Some pieces named *Atkinfons* were coined by James VI. in 1582, when the Scottifh money was to the Englifh as 1. to 8; but on its being ftill farther reduced they went for 8 pennies, a third more than the value of the baw-bee. Befides thefe there were the hardie and plack, the former being worth three and the latter four pennies Scots. This coinage continued through the reigns of Charles I. and II. but Scottifh coins of the former are, perhaps, the fcarceft of any.

24. Ireland. The firft coins introduced into this kingdom feem to have been thofe of the Danes, and which have only a number of ftrokes around them inftead of letters. In the tenth century, however, this coinage had been confiderably improved; and in 930 and 994 there are pennies ftruck in Dublin, with the infcription on DVFLI or DYFLI, *Duflin* or *Dyflin*, being the Danifh name of that city. There are likewife coins of the Irifh princes themfelves, and of the Englifh monarchs, ftruck in Ireland as early as the ninth century; and it is afferted by fome, that Ireland even in thefe days had been conquered by England; of which, indeed, thefe coins feem to be a proof. None of the Irifh coins of Henry II. are to be met with, but we have fome of the coins of John; and from his time to that of Henry V. the Irifh coins are known by a triangle inclofing the king's head, which appears alfo upon the coins of other nations at this period. The harp does not appear upon the Irifh coins till the time of Henry VIII. Till the time of this monarch, the Englifh and Irifh coins are the fame; but the fame debafement of the coin which at that time took place in England extended alfo to Ireland; but in 1601 copper halfpence and farthings were coined alfo for this kingdom. Thefe circulated in Ireland when James VI. iffued his farthing-tokens of copper, the latter being of two fizes, that if they failed in England they might be fent to Ireland as pennies and halfpence. In 1635 a mint was eftablifhed in Dublin by Charles I. but it was ftopped by the Irifh maffacre, and the many difturbances which followed; fince which time the fcheme has not been refumed. After the maffacre, St Patrick's halfpence and farthings were coined by the Papifts, bearing the legends FLOREAT REX, and on the reverfe ECCE GREX; on the farthing QUIESCAT PLEBS. Copper-tokens were ftruck by towns and tradefmen, as in England and Scotland. In 1680, halfpence and farthings were iffued by authority, with the harp and date. In 1689, James II. having invaded Ireland, inftituted a mint, and coined fhillings and half-crowns of all the refufe metal he could find, particularly fome brafs guns were employed, whence the coinage is commonly called *gun-money*. Even this metal, however, foon became fo fcarce, that a diminution in its fize is quite apparent from June 1689 to July 1690; and as the month of their mintage is marked upon them, this decrease is eafily perceived. In March 1690, pennies of lead mixed with tin were iffued; and on the 15th of June the fame year, crowns of white metal were coined; but thefe are now very fcarce. In 1722, the patent for coining halfpence and farthings was given to William Wood, which excited fuch difcontent in Ireland. From the fmall fize allowed by the patent to thefe pieces, it was fuppofed that the patentee would have gained 60,000l. but as he caufed them to be ftruck of a fize ftill fmaller, his gains were eftimated at 100,000l. The coins, however, are of admirable workmanfhip, and very fine copper, bearing the beft portrait of king George I. to be found any where. Sir Ifac Newton, at that time at the head of the mint, declared that they were fuperior to the Englifh coins in every thing except the fize. In 1737 the Irifh halfpence and farthings, with the harp on the reverfe, were coined, and continue to the prefent time. In 1760, there was fuch a fcarcity of copper coin, that fome private perfons applied for leave to coin halfpence, which appeared with a very bad portrait of George II. and the words VOCE POPULI around it. No gold or filver has been coined in Ireland fince the maffacre of 1641.

TABLE V. *Modern Medals, properly fo called.*

1. Scottifh medals. Thefe take the lead in the prefent article, the firft modern medals of gold being thofe of David II. ftruck between the years 1330 and 1370. Only two of them now exift; one in the collection of Mr Barker of Birmingham, and the other in that of Dr Hunter. In 1478, there is a medal of James III. fent to the fhrine of St Amboife in France. It is defcribed as of two inches and a third in diameter: the weight near two ounces; having on the obverfe a beardlefs king, with long hair, fitting on a throne, holding in one hand a naked fword; in the other a fhield, with the Scottifh arms. On the borders of the canopy above the throne is an infcription in Gothic letters, IN MI DEFFEN, being corrupt French

Modern Medals.

French for *In my defence;* a common motto in the Scottish arms. Above the canopy is VILLA BERWICI: the reverse bears St Andrew and his cross, SALVUM FAC POPULUM TUUM DOMINE. There is also a medal of James IV. in the collar of St Michael, having on the reverse a Doric pillar surmounted by a young Janus, standing on a hill, beyond which is the sea, and land on either side. This, however, is by some suspected to be a forgery.

The most remarkable Scottish medals are those of the unfortunate Mary. The first is properly French, having been issued at her coronation as queen of France, along with her husband king Frances II. On the obverse of this piece there are portraits of Francis and Mary, face to face, with three legends around them, the outermost containing their titles; the middle one the following sentence: HORA NONA DOMINUS J. H. S. EXPIRAVIT HELLI CLAMANS; the innermost the name of the city (Paris). On the reverse are the arms of France and Scotland. Fine testoons were also coined upon the same plan, and are now so rare that Dr Hunter gave ten guineas for one he has in his collection. The same portraits appear on the fine crown of Mary and Henry, in 1565, which is so rare as to be esteemed a medal of the highest value; and Mr Pinkerton imagines, that if brought to a sale it would bring 40 or 50 guineas.

Another remarkable medal of Mary represents her full faced, and weeping, with the inscription, O GOD GRANT PATIENCE IN THAT I SUFFER VRANG. The reverse has in the centre, QUHO CAN COMPARE WITH ME IN GRIEF, I DIE AND DAR NOCHT SEEK RELIEF; with this legend around, HOURT NOT THE (figure of a heart) QUHAIS JOY THOU ART. There are also many counters of this unfortunate princess, being thin silver-pieces of the size of a shilling. "They all appear (says Mr Pinkerton) to have been done in France by Mary's direction, who was fond of devices. Her cruel captivity could not debar her from intercourse with her friends in France, who must with pleasure have executed her orders, as affording her a little consolation."

The coronation medal of Charles I. struck at Edinburgh for his inauguration, June 18. 1663, is remarkable as being the only one ever coined of Scottish gold, and the first in Britain struck with a legend on the edge. With respect to the workmanship, it is inferior to Simon's. Of these medals only three are known to exist, of which one is in the Museum. It is not uncommon in silver; in which case it sometimes wants the legend on the edge.

2. Italian medals. These appear in the 15th century, and from that time successively in most European countries. Vittore Pisano, a painter of Verona, is celebrated as the restorer of the art, but it remains to be accounted for how the medals of king David already mentioned came to exist so long before. Mr Pinkerton considers this artist rather as an inventor than a restorer, his medals having no resemblance to the ancient coins, as being large, and all cast. They were first modelled in wax, then a mould taken from the model in fine sand, and other ingredients. After a good cast was procured, it was touched up, and made a model for the rest. These medals of Pisano are almost always inscribed *Opus Pisani Pictoris*. The portraits of a great number of illustrious men were done by him in this manner; and in the British Museum is a large brass medal of Pisano by himself.—Other artists were Boldu, Morescotto, Matthæus de Pastus, Sperandes, Misaldone, &c. Towards the end of the century, however, the medals began to assume a more elegant appearance; and the Papal ones are not only the most elegant but the most ancient series of all the modern medals. The improvement began in the reign of Alexander VI. so famous for his own crimes, and those of his nephew Cæsar Borgia. His successors, Julius II. Leo X. Hadrian VI. and Clement VII. had many of their medals designed by Raphael, Julio Romano, and other eminent painters, and the engraving executed by artists of equal merit. Among these were the celebrated Cellini, and the noted Paduan forgers of Roman coins, Cavino and Bassiano. In 1644 Cormanni, a medallic artist, was imprisoned on account of a piece which represented the Pope upon one side, and Olympia Maidalchina, the *relation* of his holiness, on the other. The unfortunate Cormanni poisoned himself. About this time the family of the Hamerani, originally from Germany, began to engrave the papal medals; which they did with surprising merit for several generations. Each of the daughters did a fine medal, as we are informed by Venuti.

Besides the papal medals, there are many issued by the various states of Italy. There are medals of Frederic II. of Sicily in 1501, of several Venetian generals in 1509, of Alfonso duke of Ferrara in 1511, and of the celebrated Andrew Doria in 1528.

3. French medals. Till the reign of Louis XIV. the medals of this country are neither fine nor numerous; but this monarch exceeds all modern princes in this way. Many of his pieces are well designed and executed, though objectionable on account of their falsehood.

4. Danish medals. These appear of Christian II. in 1516, of Frederic and Sophia in 1532, of Frederic I. and Christian III. in bonnets worn in the 16th century. The elephant of the house of Oldenburg is frequent upon Danish medals.

5. Swedish medals. These begin with Gustavus Vasa; and several of Christiana are likewise to be met with. There are also some curious ones of Charles XII.

6. Dutch Medals. These begin in 1566; and many of them are remarkable for maps and plans, which must be very interesting to posterity. "Had the Greeks and Romans (says Mr Pinkerton) given us maps and plans, what a fine system of ancient geography and topography a cabinet of medals must have been!"

7. Medals of Spain, Portugal, and Germany. The Spanish medals began with Gonsalo in 1503, many of which are curious and interesting. Under Cha. V. there are many curious Spanish medals; but those of Germany begin with Frederic in 1453. They are extremely numerous; as we may easily suppose from the greatness of the empire, and the various states which compose it. There is a famous medal of Sebastian king of Portugal, famous for his unfortunate expedition into Africa in 1578; with his bust, full face, and three quarters in length. On the reverse is a shell-fish in the sea, with the moon and seven stars, bearing the inscription SERENA CALSA FAVENT. There is also a curious lozenge-shaped coin of the same with the arms of Portugal, and the king's name and title; On the reverse

Modern Medals.

reverse is a cross with the inscription IN HOC SIGNO VINCES, 1578.

8. Satyric medals. These began almost as soon as the knowledge of the art of coining medals was revived. They seem to have been almost unknown to the ancients. One indeed of the Emperor Gallienus is supposed to have been satyric. It has on the front the emperor's bust, with the inscription GALLIENÆ AUG. the reverse is Peace in a car, PAX UBIQUE; but this has been proved to be only a blundered coin. Some other ancient medals, however, are not liable to this objection. The first modern satyric medal published was that of Frederic king of Sicily in 1501 against his antagonist Ferdinand king of Spain. It has on one side the head of Ferdinand, with the inscription FERDINANDUS R. AR. VETUS VULPES ORBIS; on the reverse a wolf carrying off a sheep, JVGVM MÆVM SVAVE EST ET ONVS MEVM LEVE. Many others have been struck, of which the wit would now perhaps be difficult to be found out; but of all nations the Dutch have most distinguished themselves in this way, and paid very dear for their conduct, as they brought upon themselves by one or two satyric medals the whole power of France under Louis XIV.

9. English medals. The first of these is in the duke of Devonshire's collection. It is of a large size, and done on the plan of the early Italian medals. It has on the reverse the arms of Kendal, with the inscription TEMPORE OBSIDIONIS TURCORUM, MCCCCLXXX. On the other side is a portrait with IO. KENDAL RHODI TVRCVPELLERIVS. It was found last century in Knaresborough forest; but Mr Pinkerton has no doubt of its having been done in Italy. The next is that of Henry VIII. in 1545, and is of gold, larger than the crown-piece, with the king's head upon the obverse, and three legends within each other, including his titles, &c. The reverse contains two inscriptions, declaring him to be the head of the church; the one in Hebrew, the other in Greek. It was imitated exactly by Edward VI. whose coronation-medal is the first we have. There are two medals of Philip and Mary, whose execution is tolerably good; but those of Elizabeth are very poor. There are good medals of James I. and his queen; with a fine one of Charles I. and Henrietta, though the workmanship is much inferior to the antique. There are many good medals of Charles, with various devices upon their reverses. Under the commonwealth the celebrated Simon produced medals which are deservedly reckoned the most admirable pieces of modern workmanship. There are many good medals of Charles II. James II. and William III. Some are also found of James after his abdication. Some fine gold, silver, and copper medals, were issued in the time of Queen Anne; the two last affording a series of all the great actions of the duke of Marlborough. About the year 1740, a series of medals was engraved in London by Dassier, a native of Geneva, containing all the kings of of England; being 36 in number. They are done upon fine copper, and executed with great taste. There are besides many medals of private persons in England; so that it may justly be said, that this country for medals exceeds almost every other in Europe.

Abbreviations.

To this account of modern coins and medals we shall add that of another set called *siege pieces*, and which were issued during the time of a siege in cases of urgent necessity. These were formed of any kind of metal; sometimes of no metal; and Patin mentions a remarkable one struck at Leyden in 1574, when the place was besieged by the Spaniards. It was of thick paper or pasteboard, having a lion rampant, with this inscription, PVGNO PRO PATRIA, 1574; and on the reverse, LVGDVNVM BATAVORVM. There are various siege-pieces of Charles I. both in gold and silver, some of the latter being of the value of 20 shillings.

The *nummi bracteati* are a species of modern coins somewhat between counters and money; and have their name from the word BRACTEA, a spangle or thin bit of metal. They are commonly little thin plates of silver, stamped as would seem with wooden dies upon one side only, with the rude impression of various figures and inscriptions. Most of them are ecclesiastic, and were struck in Germany, Switzerland, Denmark, Sweden, Norway, and a few in Poland. They continued to be in use in Germany till the end of the 15th century; and some are still used in Switzerland at this day.

Table of Abbreviations used in the Legends of Medals; from Mr Pinkerton.

Greek Coins.

A

A. Athens, Argos, Aulus, Asylum; primi or first; as Εφεσιων Α. Ασιας, "Ephesians first people of Asia"
A. Abbassus, Abdera, Abydus on Hellespont
AB. Abydus in Egypt
ABT. Abydus on Hellespont
AΘ. AΘE. Athens
AΠ. Aegina
AΠΓOΣΠO. Aigospotamos
AIA. Aelius, Aelia Capitolina
AIN. Aenos
AK.-AKPATAN. Agrigentum
AKI. Acilium
AKT. Actium
AAE. Alexandria
AM. Amyntas
AMBP. Ambracia
AMΦI. Amphilochia
ANΘ. Ανθυπατον, Proconsul
ANTIΣ. Antissa
ANA. Anactoria
ANTI. Antium
AN. Ancyra
ANT. Antoninus, Antioch
AΣ. Axus in Crete
AON. Aonitæ
AOYE. Avenio, *Pell.*
AΠ. Appius
AΠA. Apamea
AΠO. Apollonia
AΠTA. Aptara
AP. Aradus, Harma
APΓE. Argennos
APΓ. Argos
API. Aricanda
APIM. Ariminum
APΣI. Arsinoe
APY. Aryca
APX. Αρχιερευς or Αρχον, high priest or magistrate
ΑΣΙΑΡΧ. Arsiarchæ, presidents of the games of Asia (B)
AΣ. Asylum
A. Σ. Προτοι Συριας, First of Syria
AΣK. Ascalon
AT. Atabyrium
ATAP. Atarnæ
AYΓ. Augustus
AYPHA. Aurelius
AY. AYΓ. Αυτοκρατορ Emperor
AYTON. Αυτονομοι, enjoying their own laws
AΦI. Aphyta
AΦP. Africanus
AX. Achaii

B

B. Βουλης, Council: Berytus: Bithynia
BAΓHΔAO. Bagadonia
BAA. Valerius

BH.

(B) There were also Syriarchæ, Lyciarchæ, Galatarchæ Bithyniarchæ, Cappadociarchæ, &c. *Morel. Spec.*

Abbreviations.

ΒΗ. Berytus
ΒΙΤΟΝ. Bitontum
ΒΟΙ. Bœtia
ΒΡΥΝ. Brundusium
ΒΥ. Byzantium

Γ

Γ. ΓΡ. ΓΡΑΜ. Grammaticus, or keeper of the records
Γ. Gaius, or Caius
ΓΑ. Gallus, Gallerius, Gallienus
Γ. Γνωριμου, Illustrious.
ΓΕΛ. Gelas
ΓΕΡ. Germanicus
ΓΝ. Gneius
ΓΟΡΤΥ. Gortyna
ΓΡΑ. Gravisca

Δ

Δ. Decimus, Dymæ
ΔΑΚ. Dacicus
ΔΑΜ. Damascus
ΔΑΡ. Dardanum
ΔΗ. Δημος, the people
ΔΗΜΑΡΧ. ΕΞΟΥΣ. with Tribunitian power
ΔΕ. Decelia
ΔΕΚ. Decius
ΔΕΡ. Derbe in Lycaonia
ΔΗ. Delos
ΔΙ. Diospolis
ΔΡΕ. Drepanum
ΔΥΡ. Dyrrhachium

Ε

Ε. Eryce
Ε. ΕΡΕΣ. Erefus
ΕΛΕΥ. Eleusis
ΕΛΕΥΘ. Ελευθεροι, Free
ΕΠΙ. Epidaurus
ΕΡΙ. Eriza in Caria
ΕΡΧ. Erchia
ΕΡΥ. Erythræ
ΕΤ. ΕΤΟ. Ετους, Year
ΕΤ. Etenna in Pamphylia
ΕΧ. Εχουσια, Power
ΕΥ. ΕΥΒΟ. Eubœa
ΕΥΣ. Ευσεβης, Pious
ΕΥΤ. Ευτυχης, Happy
ΕΦ. ΕΦΕ. Ephesus

Ζ

ΖΑ. Zacynthus
ΖΑΝΚΛ. Zancle, Messana anciently so called

Η

Η. Elium
ΗΓ. Ηγεμονος, President
ΗΡΑΚ. Heraclea

Θ

ΘΑ. Thasius
ΘΕ. Thespiæ
ΘΕΣ. Thessalonica
ΘΗ. ΘΗΒ. Thebæ.

Ι

Ι. ΙΕΡ. Ιερας, Sacred
ΙΕΡΑΠΥ. Hyerapytha
ΙΚΑΡ. Hiccara
ΙΛΙ. Ilium
ΙΟΥ. Julis a city, or Julius
ΙΟΥΛ. Julia
ΙΠΑ. Hippana
ΙΡ. Irene Inf. *Pellerin.*
ΙΣ. Isus, Istiæa

Κ

Κ. Caius; Κουιντος, Quintus
Κ. ΚΑΙΣ. Cæsar
Κ. Κ. Κοινον, Κιλικιας, Community of Cilicia
ΚΑΙΛ. Cælius
ΚΑΛ. Chalcedon
ΚΑΛΛΙ. Callipolis
ΚΑΜΑ. Camara
ΚΑΝ. Canata
ΚΑΠ. Capua
ΚΑΠΠ. Cappadocia
ΚΑΡ. Carrhæ
ΚΑΡΤ. Carthago
ΚΑΥ. Caulonia
ΚΕ. Ceos
ΚΕΦ. Cephalædis
ΚΙ. Cianus, Cibæum
ΚΙΛ. Cilbiani
ΚΛ. Clæonæ, Cladius
ΚΛΑ. Clazomene
ΚΝΙ. Cnidus
ΚΟ. Corinth
ΚΟΙΝ. Κοινον, Community
ΚΟΛ. Κολονιας, Colony, Colophon
ΚΟΜ. Commodus
ΚΟΡ. Corcyra
ΚΡ. Cragus in Lycia
ΚΡΑ. Cranos
ΚΡΗ. Crete
ΚΤΗ. Ctemenæ, *Pell.*
ΚΥ. Cuma, Cydonium, Cyon
ΚΥΘ. Cythnus
ΚΥΠ. Cyprus
ΚΥΡ. Cyrene

Λ

Λ. or L. Λυκαβαντος, Year
Λ. Lucius
ΛΑ. Lacedæmon
ΛΑΜ. Lamea; Lampsacus
ΛΑΡ. Larissa
ΛΑΡΙ. Larinum
ΛΕ ΛΕΥ. Leucas
ΛΕΟΝ. Leontium
ΛΗΜ. Lemnos
ΛΙΠ. Lipara
ΛΙΥΙ. Liviopolis
ΛΟ. ΛΩΚ. Locri.
ΛΟΓ. Longone
ΛΥΓ. ΛΥΚ. Lyctus

Μ

Μ. Marcus, Malea, Megalopolis, Mazaka
ΜΑ. Maronea, Massilia, Macedonia
ΜΑΓ. Magnesia
ΜΑΚΡΟ. Macrocephali
ΜΑΜ. Mamertini
ΜΑΣΣ. Massilia
ΜΑΖ. Mazara
ΜΕ. Menelais, on Syrian regal coins
ΜΕΝΕΚ. Menecrates
ΜΕ. ΜΕΓ. Megara, Megalopoli, Melite
ΜΕΓ. Μεγαλος, Great
ΜΕΣ. Messana
ΜΕΤΑ. Metapontum
Μ. ΜΗΤΡΟ. Metropolis
ΜΙ. Miletus
ΜΚ. Mazaka of Cappadocia, on coins of Mithridates VI.
ΜΟΡ. Morgantia
ΜΥ. Mycenæ.
ΜΥΡ. Myrlea
ΜΥΤΙ. Mytilene

Ν

Ν. Naupactus
ΝΑΞ. Naxos
ΝΑΥΑΡΧ. Ναυαρχιδοι, enjoying a sea-port.
ΝΕ. Nemea
Ν. ΝΕΩΚ. Neocori
ΝΕΟΠ. Neopolis.
ΝΕΡ. Nerva
ΝΙΚ. Nicæum, Nicomedia
ΝΥΣ. Nysæi, on coins of Scythopolis, *Pell.*

Ο

ΟΙ. Oethæi
ΟΝ. Οντος, being
ΟΠΕΛ. Opelius
ΟΠ. Opus
ΟΡΥ. Orycas
ΟΡΧ. Orchomenus
ΟΥΠ. or ΥΠ. Υπατος or Υπατος, Consul
ΟΥΕΡ. Verus
ΟΥΗ. Verus
ΟΥΕΣΠ. Vespasianus
ΟΥΙΤΕΛ. Vitellius
ΟΦΡΥ. Ophrynium

Π

Π. Παρα, προς, upon
Π. ΠΟΠΛ. Publius
Π. ΠΑ. Paphos or Paros
ΠΑΙΣ. Pæstum
ΠΑΝ. Panormus
ΠΑΡ. Paropinum
ΠΑΡΙ. Paros
ΠΑΡΘ. Parthicus
ΠΕ. Perinthus
ΠΕΛ. Pella
ΠΕΡ. Pergus
ΠΕΡΤ. Pertinax
ΠΕΣΚ. Pescennius
Π. ΠΗ. Pelusium
ΠΙΝ. Pinamytæ
ΠΛΑ. Plateæ
ΠΟ. Pontus
ΠΟΛΥ. Polyrrhenum
ΠΟΣ. Posidonia
ΠΡΑΣ. Prassus
Π. ΠΡΥ. Πρυτανος, Præfect
ΠΡ. ΠΡΕΣ. Πρεσβευς, Legate
ΠΡΟ. Proconnesus
ΠΡΟΔΙ. Προδικος, Curator
Π. ΠΡΩΤ. Προτος, First
ΠΤ. Ptolemais
ΠΥ. Pylos

Ρ

ΡΟ. Rhodes

Σ

Σ. ΣΑ. Salamis, Samos, Syria
ΣΑ. Samosate
ΣΑΛΑΠ. Salapia
ΣΑΡ. Sardis
ΣΕ. Seriphus, Segeste
ΣΕΒ. Σεβαστος, Augustus
ΣΕΛ. Selinus, Seleucia
ΣΕΠΤ. Septimius
ΣΙ. Siphnos
ΣΙΔ. Side
ΣΙΝΩ. Sinope
ΣΜΥ. Smyrna
ΣΤΡ. ΣΤΡΑ. Στρατηγος, Prætor
ΣΥΒ. Sybaris
ΣΥ. ΣΥΡΑ. Syracuse
ΣΥΡ. Syria
ΣΩ. Solæ.

Τ.

Τ. Titus
ΤΑΒΑΛ. Tabala
ΤΑ. ΤΑΝΑ. Tanagra
ΤΑΡ. Tarentum, Tarsus
ΤΑΥΡ. Tauromenum
ΤΕ. Tementis
ΤΕΡ. Terina
ΤΗ. Tenus
ΤΙ. ΤΙΒ. Tiberius
ΤΡΑ. Trallis
ΤΡΙ. Tripolis.
ΤΡΟ. Troizene
ΤΥΑΝ. Tyana
ΤΥ. Tyndaris
ΤΥΡ. Tyre (monogram)

Υ

ΥΕ. ΥΕΛ. Velia
ΥΠ. ΥΠΑΤ. Υπατος, Consul

Φ

Φ. Philip; Phœstus, Philuntium
ΦΑ. Phaselis
ΦΑΡ. Pharsalus
ΦΙ. Vibius, Phillippopolis
ΦΙΝΕ. Phineium
ΦΛ. Flavius
ΦΟΚ. Phoceum
ΦΟΥΛ. Fulvia
ΦΥ. Phycus in Cyrene

Χ

Χ. Chios
ΧΑΛ. Chalsis
ΧΕΡ. Chersonesus
ΧΙ. Chytri in Crete

Abbreviations.

Greek Numerals.

Α.	1.	Ι.	10.	Ρ.	100.
Β.	2.	Κ.	20.	Φ. or C	200.
Γ.	3.	Λ.	30.	Τ.	300.
Δ.	4.	Μ.	40.	Υ.	400.
Ε	5.	Ν.	50.	Φ.	500.
ϛ. or ϟ	6.	Ξ.	60.	Χ.	600.
Ζ.	7.	Ο.	70.	Ψ.	700.
Η.	8.	Π.	80.	Ω.	800.
Θ.	9.	ϙ or ϟ	90.	ϡ.	900.

Examples. I is 10: add A or I, and IA makes 11: so IB, 12; IΓ, 13, &c. K is 20, KA, 21, &c. PIA makes 111. The English word AIR marks the grand initial numerals. On coins the numerals are often placed in retrograde order; which makes no difference in the value, as every letter is appropriated to its number. Thus TAΓ or ΓAT imply the same, 333. But the advantage being unknown to the Roman numerals and Arabic ciphers, is apt to puzzle the beginner.

Roman Coins.

A

A. AULUS: in the exergue it implies the first mint, as ANT. A. coined at Antioch in the first mint.

A. A. A. F. F. Auro, Argento, Ære, Flando, Feriundo.

A. or AN.. Annus.

A. A. Apollo Augusti.

A. F. A. N. Auli filius, Auli nepos.

ABN. Abnepos.

ACT. Actiacus, or Actium.

AD. FRV. EMV. Ad fruges emundas.

ADIAB. Adiabenicus.

ADOP. Adoptatus.

ADQ. Adquisita.

ADV. Adventus.

AED. Ædes.

AED. P. Ædilitia potestate.

AED. S. Ædes sacræ.

AED. CVR. Ædilis Curules.

AED. PL. Ædilis Plebis.

AEL. Ælius.

AEM. or AIMIL. Æmilius.

AET. Æternitas.

AFR. Africa, or Africanus.

ALBIN. Albinus.

ALIM. ITAL. Alimenta Italiæ.

ANN. AVG. Annona Augusti.

A. N. F.F. Annum Novum Faustum Felicem.

ANIC. Anicius.

ANN. DCCCLXIIII. NAT. VRB. P. CIR. CON. Anno 864 Natali Urbis Populo Circenses constituti.

ANT. AVG. Antonius Augur.

ANT. Antonius, or Antoninus.

AP. Appius.

A. P. F. Argento Publico Feriundo.

A. POP. FRVG. AC. A Populo Fruges Acceptæ.

AQ. or AQL. Aquilius.

AQVA MAR. Aqua Martia.

ARAB. ADQ. Arabia Adquisita.

ARR. Arrius.

AVG. Augur, Augustus, Augusta.

AVG. D. F. Augustus Divi Filius.

AVGG. Two Augusti.

AVGGG. Three Augusti.

AVR. or AVREL. Aurelius.

B

B. The mark of the second mint in any city.

BON. EVENT. Bonus Eventus.

B.R.P. NAT. Bono Reipublicæ Nato.

BRIT. Britanicus.

BRVT. Brutus.

C

C. Caius, Colonia.

C. A. Cæsarea Augusta.

C. CAE. or CAES. Cæsar.

CAESS. Cæsares.

CARTH. Carthage.

CEN. Censor.

CENS. P. Censor Perpetuus.

CEST. Cestius, or Cestianus.

CIR. CON. Circum Condidit, or Circenses Concessit.

CIVIB. ET SIGN. MILIT. A. PARTH. RECVP. Civibus et Signis Militaribus a Parthis Recuperatus.

CN. Cneius.

COEL. Cœlius.

CON. OB. Constantinopoli Obsignata, or Constantinopoli Officina secunda, or Conflata Obryzo.

COL. Colonia.

CON. SVO. Conservatori suo.

CONCORD. Concordia.

CL. V. Clypeus Votivus.

COMM. Commodus.

CLOD. Clodius.

CL. or CLAVD. Claudius.

COS. Consul.

COSS. Consules.

CORN. Cornelius.

CVR. X. F. Curavit Denarium Faciendum.

D

D. Decimus, Divus, Designatus.

DAC. Dacicus.

D. F. Dacia felix.

D. M. Diis Manibus.

DES. or DESIG. Designatus.

DICT. Dictator.

DOMIT. Domitianus.

D. N. Dominus noster.

DID. Didius.

D. P. Dii Penates.

DV. Divus.

E

EID. MAR. Idus Martiæ.

EX. CONS. D. Ex Consensu Decuriorum.

EX. S. C. Ex Senatus Consulto.

EQ. ORDIN. Equestris Ordinis.

EX. A. PV. Ex Argento, or Auctoritate Publica.

EXER. Exercitus.

ETR. Etruscus.

F.

F. Filius, or Filia, or Felix, or Faciundum, or Fecit.

FEL. Felix.

FELIC. Felicitas.

FL. Flavius.

FLAM. Flamen.

FORT. RED. Fortunæ Reduci.

FOVRI. Fourius for Furius.

FONT. Fonteius.

FRVGIF. Frugiferæ (Cereri).

FVL. Fulvius.

FVLG. Fulgerator.

G

G. Gneius, Genius, Gaudium.

GA. Gaditanus.

G. D. Germanicus Dacicus.

GEN. Genius.

GERM. Germanicus.

GL. E. R. Gloria Exercitus Romani.

GL. P. R. Gloria Populi Romani.

GOTH. Gothicus.

G. P. R. Genio Populi Romani.

G. T. A. Genius Tutelaris Ægypti, or Africæ.

H

HEL. Helvius.

HEL. Heliopolis.

HER. Herennius, or Herennia.

HO. Honos.

HS. Sestertius.

I

I. Imperator, Jovi, Julius.

IAN. CLV. Janum clusit for clausit.

IMP. Imperator.

IMPP. Imperatores.

I. S. M. R. Juno Sospita, Mater or Magna Regina.

IT. Italia, Iterum.

ITE. Iterum.

IVL. Julius or Julia.

IVST. Justus.

I-I. S. Sestertius.

I. O. M. SACR. Jovi Optimo, Maximo, Sacrum.

II. VIR. Duumvir.

III. VIR. R. P. C. Triumvir Reipublicæ Constituendæ.

IIII. VIR. A. P. F. Quatuorvir, or Quatuorviri, Auro, or Argento, or Ære, Publico Feriundo.

IVN. Junior.

L.

L. Lucius.

LAT. Latinus.

LEG. PROPR. Legatus Proprætoris.

LEG. I. &c. Legio Prima, &c.

LEP. Lepidus.

LENT. CVR. X. F. Lentulus Curavit Denarium Faciundum.

LIBERO P. Libero Patri.

LIB. PVB. Libertas Publica.

LIC. Licinius.

L. S. DEN. Lucius Sicinius Dentatus.

LVC. Lucifera.

LVD. CIR. Ludi Circenses.

LVD. EQ. Ludi Equestres.

LVD. SAEC. F. Ludos Sæculares Fecit.

Abreviations.

M

M. Marcus, or Marius.
MAR. CL. Marcellus Clodius.
M. F. Marci Filius.
M. OTACIL. Marcia Otacilia.
MAG. or MAGN. Magnus.
MAC. Macellum.
MAX. Maximus.
MAR. VLT. Marti Ultori.
MES Messius.
METAL. Metallum.
MINAT. Minatius.
MINER. Minerva.
M. M. I. V. Municipes Municipii Julii Uticensis.
MON. or MONET. Moneta.

N

N. Nepos or noster.
N. C. Nobilissimus Cæsar.
NAT. VRB. Natalis Urbis.
NEP. Nepos.
NEP. RED. Neptuno Reduci.

O

O. Optimo.
OB. C. S. Ob Cives Servatos.
OF. Officina.
OPEL. Opelius.
ORB. TERR. Orbis Terrarum.

P

P. or POT. Potestate.
PAC. ORB. TER. Pacatori Orbis Terrarum.
PAPI. Papius or Papirius.
PARTH. Parthicus.
PERP. Perpetuus.
PERT. or PERTIN. Pertinax.
PESC. Pescennius.
P. F. Pius Felix.
PLAET. Plætonius.
P. L. N. Pecunia Londini Notata.
P. LON. S. Pecunia Londini Signata
P. M. or PONT. MAX. Pontifex. Maximus
POMP. Pompeius.
P. P. Pater Patriæ.
PR. Prætor.
P. R. Populus Romanus.
PRAEF. CLAS. ET. OR. MARIT. Præfectus Classis et Oræ Maritimæ.
PRINC. IVVENT. Princeps Juventutis.
PRIV. Privernum.
PROC. Proconsul.
PRON. Pronepos.
PROP. Proprætor.
PROQ. Proquæstor.
PROV. DEOR. Providentia Deorum.
PVPIEM. Pupienus.

Q

Q. Quintus, or Quæstor.
Q. C. M. P. I. Quintus Cæcilius Metellus Pius Imperator.
Q. DESIG. Quæstor Designatus.
Q. P. Quæstor Prætorius.
Q. PR. Quæstor provincialis.

R

R. Roma, Restituit.
RECEP. Receptis, or Receptus.
REST. Restituit.
ROM. ET AVG. Romæ et Augusto.
R. P. Respublica.

S

SAEC. AVR. Sæculum Aureum.
SAEC. FEL. Sæculi Felicitas.
SAL. Salus.
SALL. Sallustia.
SARM. Sarmaticus.
S. C. Senatus Consulto.
SCIP. ASIA. Scipio Asiaticus.
SEC. ORB. Securitas Orbis.
SEC. PERP. Securitas Perpetua.
SEC. TEMP. Securitas Temporum.
SEN. Senior.
SEPT. Septimius.
SER. Servius.
SEV. Severus.
SEX. Sextus.
SIC. V. SIC X. Sicut Quinquennalia, sic Decennalia.
SIG. Signis.
S. M. Signata Moneta.
S. P. Q. R. Senatus Populusque Romanus.
STABIL. Stabilita (terra).
SVL. Sulla.

T

T. Titus, Tribunus.
TER. Terentius, or Tertium.
TEMP. Temporum.
TI. Tiberius.
TR. or TREV. Treveris.
TREB. Trebonianus.
TR. MIL. Tribunus Militaris.
TR. A. or TRIB. POT. Tribunicia Potestate.

V

V. Quintum.
V. C. Vir Clarissimus.
VESP. Vespasianus.
VIB. Vibius.
VICT. Victoria.
VII. VIR. EPVL. Septemvir Epulonum.
VIL. PVB. Villa Publica.
VIRT. Virtus.
VN. MR. Venerandæ Memoriæ.
VOT. X. MVLT. XX. Votis Decennalibus Multiplicatis Vicennalibus.

X

X. Decem, Denarius.
XV. VIR. SACR. FAC. Quindecim Vir Sacris Faciundis.

Abbreviations on the Exergue; from Banduri and Monaldini. Pinkerton.

A. Officina Prima.
ALE. Alexandria.
AMB. Antiochensis Moneta Secundæ Officinæ.
AN. ANT. ANTI. Antiochia.
ANB. Antiochiæ Secunda Officina: to ANH. Antiochiæ Octava Officina.
A. P. L. (In officina) Prima percussa Lugduni.
AQ. AQL. Aquileiæ.
AQ. O. B. F. Aquileiæ Officinæ Secundæ Fabrica.
AQ. P. S. Aquileiæ Pecunia Signata.
AQ. S. Aquileiæ Signata.
A. AR. ARL. Arelate.
A. SISC. Prima (in officina) Siscia.
B. SIRM. Secunda Sirmii.
B. S. L. C. Secunda Signata Lugduni.
C. Θ. Constantinopoli Nona.
COMOB. Conflata Moneta Obryzo. Only on gold or silver from a gold dye.
CON. Constantinopoli.
CONOB. Conflata Obryzo. Only on gold.
CONS. Constantinopoli.
KART. Carthago.
K. O. Carthaginensis Officina.
L. LC. LVC. LVG. Lucduni, Lugduni.
L. LON. Londini.
L. P. Lugdunensis vel Londinensis Pecunia.
LVC. P. S. Lugduni Pecunia Signata.
MOPS. Mediolani Pecunia Signata.
M. K. V. T. Moneta Kartaginensis Urbis (in officina) Tertia.
M. L. Moneta Lugdunensis vel Londinensis.
MOSTT. Moneta Officinæ Secundæ Treverorum.
MISTR. Moneta Signata Treveris.
O. Officina.
OFF. III. CONST. Officina Tertia Constantinopoli.
PARL. Percussa or Pecunia Arelate.
PLON. Pecunia Londinensis.
PLVG. Pecunia Lugdunensis.
P. R. Pecunia Romana, or Percussa Romæ.
P. T. Pecunia Treverensis.
Q. AR. Quincta Arelatensis (officina).
R. RO. ROM. Romæ.
RA. Ravennæ.
ROPS. Romæ Pecunia Signata.
S. AR. Signata Arelate.
S. CONST. Signata Constantinopoli.
SIS. Siscia.
SS. P. Siscienſis Pecunia.
SISC. V. Siscia Urbs.
SMA. Signata Moneta Antiochiæ.
S. M. HER. Signata Moneta Heracleæ.
S. M. N. Signata Moneta Nicomediæ.
S. M. R. Signata Moneta Romæ.
S. T. Signata Treveris.
TESOB. Tessalonicæ Officina Secunda.
THEOPO. Theopoli.
TR. Treveris.
TROB. Treveris Officina Secunda.

A List of Roman Colonies whose Coins remain, and Abbreviations on those Coins.

Abdera in Spain.
Acci in Spain.
Achulla in Africa.
Ælia Capitolina in Judæa.
Agrippina in Germany.
Antiochia in Pisidia.
in Syria.
Apamea in Bithynia.
Arna in Thessaly.
Astigi in Spain.
Babba in Mauritania Tingitana.
Berytus in Phœnicia.
Bilbilis in Spain.

Bostra.

Ancient Coins.

Boſtra in Arabia.
Bracara Auguſta in Spain.
Buthrotum in Epirus.
Cabellio in Gaul.
Cæſar-Auguſta in Spain.
Cæſarea in Paleſtine.
Calagurris in Spain.
Calpe in Spain.
Camalodunum in Britain.
Carrhæ in Meſopotamia.
Carteia in Spain.
Carthago in Africa.
Carthago Nova in Spain.
Caſcantum in Spain.
Caſſandria in Macedon.
Celſa in Spain.
Clunia in Spain.
Coillu in Numidia.
Comana in Cappadocia.
Corinthus in Greece.
Cremna in Piſidia.
Culla in Thrace.
Damaſcus in Celeſyria.
Dertoſa in Spain.
Deulton in Thrace.
Dium in Macedon.
Ebora in Spain.
Edeſſa in Meſopotamia.
Emerita in Spain.
Emeſa in Phœnicia.
Ergavica in Spain.
Germe in Galatia.
Graccuris in Spain.
Hadrumetum in Africa.
Heliopolis in Celeſyria.
Hippo Regius in Africa.
Iconium in Lycaonia.
Illerda in Spain.
Illergavonia in Spain.
Illeci in Spain.
Iol in Mauritania.
Italica in Spain.
Laelia in Spain.
Laodicea in Syria.
Leptis in Africa.
Lugdunum in Gaul.
Neapolis in Paleſtine.
Nemauſus in Gaul.
Neſibus in Meſopotamia.
Norba Cæſarea in Mauritanica.
Obulco in Spain.
Oea in Africa.
Olba in Pamphylia.
Oſca in Spain.
Oficarda in Spain.
Panormus in Sicily.
Parium in Myſia.
Parlais in Lycaonia.
Patricia (Corduba) in Spain.
Pella in Macedon.
Philippi in Macedon.
Philippopolis in Arabia.
Ptolemais in Phœnicia.
Ruſcino in Gaul.
Romula (Hiſpalis) in Spain.
Rheſæna in Meſopotamia.
Sabaria in Hungary.
Saguntum in Spain.
Sebaſte in Paleſtine.
Segobriga in Spain.
Sidon in Phœnicia.
Singara in Meſopotamia.
Sinope in Pontus.
Stobi in Macedon.
Tarraco in Spain.
Theſſalonica in Macedon.
Traducta (Julia) in Spain.
Troas in Phrygia.
Turiaſo in Spain.
Tyana in Cappadocia.
Tyrus in Phœnicia.
Valentia in Spain.
Vienna in Gaul.
Viminacium in Mœſia.
Utica in Africa.

Abbreviations on Colonial Coins.

ACCI. Accitana Colonia, *Gaudix in Spain.*
ADI. Adjutrix *legio.*
AEL. MVN. COEL. Ælium Municipium Cœla, *near Seſtos on the Helleſpont.*
AST. Aſtigitana, *Eceja* in Andaluſia.
B. A. Braccara Auguſti, *Brague in Portugal.*
C. A. Cæſaria Antiochiæ.
C. A. A. P. or PATR. Colonia Auguſta Aroe Patrenſis.
CAB. Cabellio.
C. A. BVT. Colonia Auguſti Buthrotum, *in Epirus.*
C. A. C. Colonia Auguſta Cæſarea.
C. A. I. Colonia Auguſta Julia, *Cadix.*
C. A. E. Colonia Aug. Emerita, *Merida.*
CAL. Calagurris, *Calahora in Spain.*
C. A. O. A. F. Colonia Antoniana Oea Aug. Felix, *Tripoli in Africa.*
C. A. PI. MET. SID. Colonia Amelia Pia Metropolis Sidon.
C. A. R. Colonia Auguſta Rauracorum, or Colonia Aſta Regia: Auguſt. in Switzerland, or Aſt near Xeres de la Frontera in Spain.
C. C. A. Colonia Cæſarea Auguſta, *Saragoſſa in Spain.*
C. C. COL. LUG. Claudia Copia Colonia Lugdunenſis.
C. C. I. B. Colonia Campeſtris Julia Babba, *in Mauritania.*
C. C. I. B. D. D. Colonia Campeſtris Julia Babba, Decreto Decurionum.
C. C. I. H. P. A. Colonia Concordia Julia, Hadrumetina, Pia Auguſta.
C. CIV. D. D. P. Corona Civica data Decreto Publico.
C. C. N. A. Colonia Carthago Nova Auguſta.
C. C. N. C. D. D. Colonia Concordia, Norba Cæſareana, Decreto Decurionum.
C. COR. Colonia Corinthus.
C. C. T. Ducenteſima Remiſſa.
C. C. S. Colonia Claudia Sabaria, *in Hungary.*
C. F. P. D. Colonia Flavia Pacenſis Develtum, *Develtum in Thrace.*
C. G. I. H. P. A. Colonia Gemella Julia Hadrians, Pariana, Auguſta.
C. I. C. A. Colonia Julia Concordia, Apamea.
C. I. A. D. Colonia Julia Auguſta Dertona, *Tortona near Milan.*
C. I. AV. Colonia Julia Aug. *Cadiz.*
C. I. AVG. F. SIN. Colonia Julia Auguſta Felix Sinope.
C. I. B Colonia Julia Balba, *in Mauritania.*
C. I. C. A. P. A. Colonia Julia Carthago Auguſta Pia Antiqua, or Corinth, or Carthago Nova
C. I. CAL. Colonia Julia Calpe, *Gibraltar.*
C. I. F. Colonia Julia Felix, *Cadiz.*
C. I. G. A. Colonia Julia Gemella (c) Auguſta.
C. I. I. A. Colonia Immunis Illice Auguſta, *Elche in Spain.*
C. I. N. C. Colonia Julia Norba Cæſareana, or Alcantara: ſometimes it means Col. Julia Nova Carthago.
C. I. V. Colonia Julia Valentia, *Valencia in Spain.*
C. V. T. Colonia Victrix Tarraco.
C. L. I. COR. Colonia Laus Julia Corinthus.
C. L. I. N. AVG. Colonia Laus Julia Nova Auguſta, *Laus or Lodi in Lucania.*
C. M. L. Colonia Metropolis Laodicea, *in Cœleſyria.*
CO. DAM. METRO. Colonia Damaſcus Metropolis.
COHH. PRET. VII. P. VI. F. Cohortes Prætorianæ Septimum Piæ, Sextum Felices.
COH. I. CR. Cohors prima Cretenſis.
COH. PRET. PHIL. Cohors Prætoriana Philippenſium.
COL. AEL. A. H. MET. Colonia Ælia Auguſta Hadrumetina Metropolis, *in Africa.*
COL. AEL. CAP. COMM. P. F. Colonia Ælia Capitolina Commodiana Pia Felix.
COL. ALEX. TROAS. Colonia Alexandriana Troas.
COL. AMAS. or AMS. Colonia Amaſtriana, *in Paphlagonia.*
COL. ANT. *Antioch in Piſidia.*
COL. ARELAT. SEXTAN. Colonia Arelate Sextanorum, *Arles.*
COL. AST. AVG. Colonia Aſtigitana Auguſta, *Eceja in Spain.*
COL. AVG. FEL. BER. Colonia Auguſta Felix Berytus.
COL. AVG. FIR. Colonia Aug. firma, *Eceja.*
COL. AVG. IVL. PHILIP. Colonia Auguſta Julia Philippenſis.
COL. AVG. PAT. TREVIR. Colonia Auguſta Paterna Trevirorum, *Treves in Germany, ſent from Paternum in Italy.*

COL.

(c) Gemella implies a colony drawn from two others.

MEDALS.

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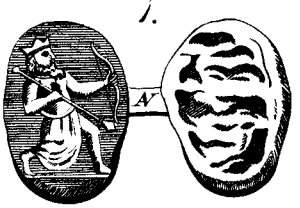

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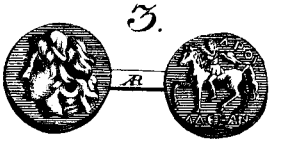

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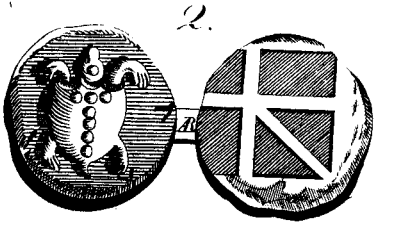

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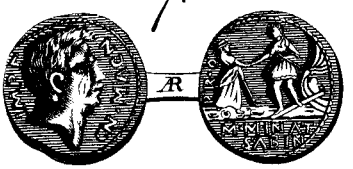

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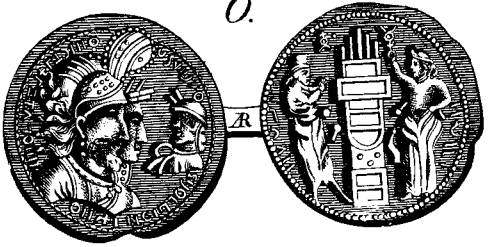

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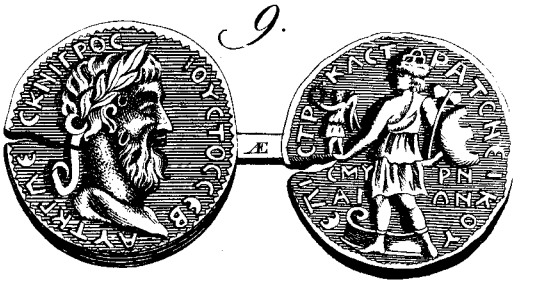

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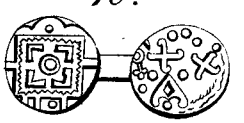

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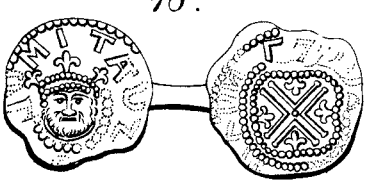

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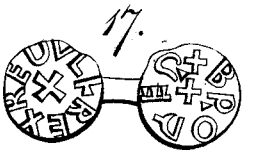

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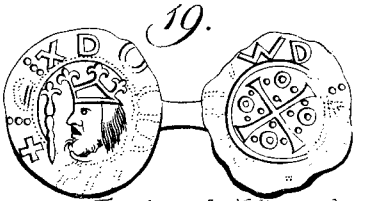

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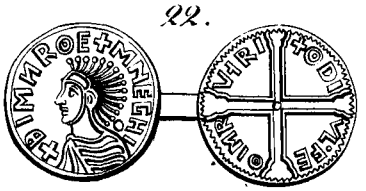

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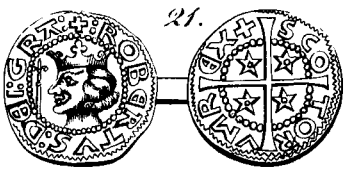

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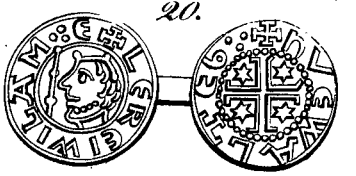

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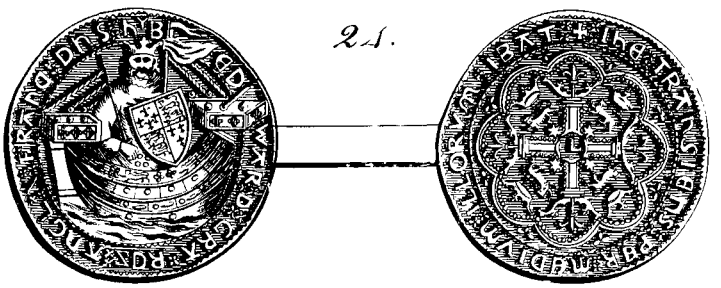

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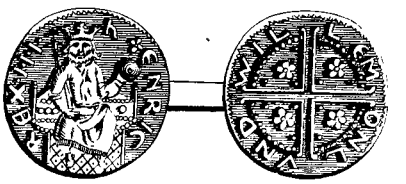

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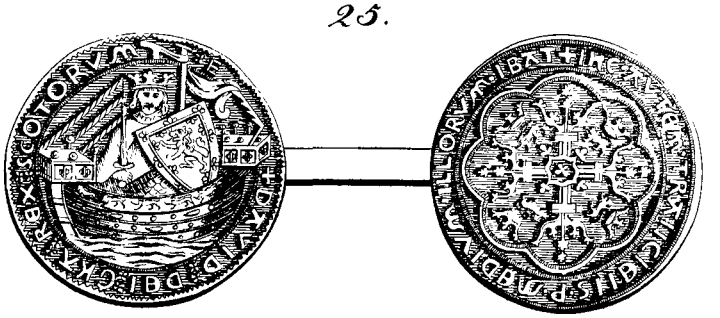

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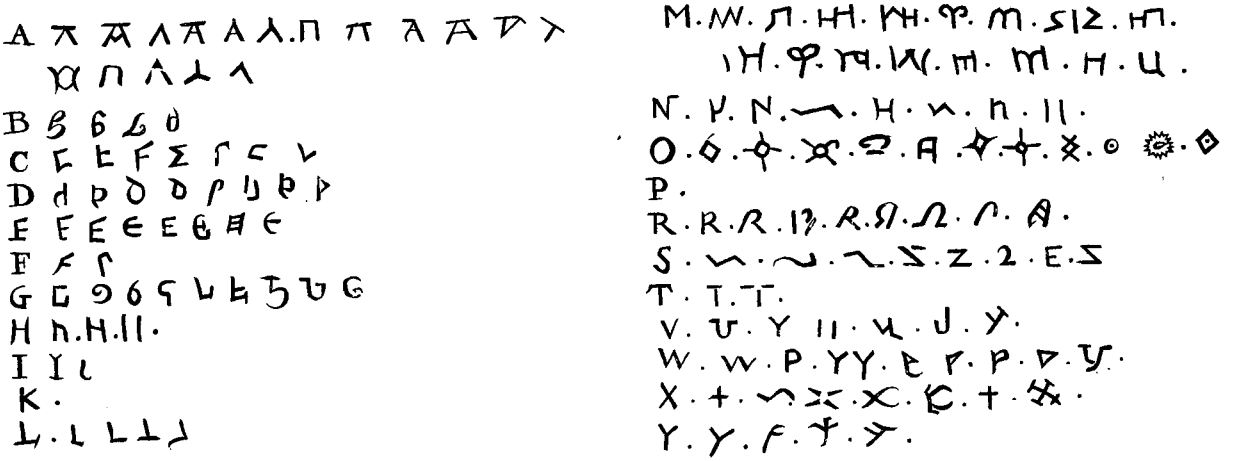

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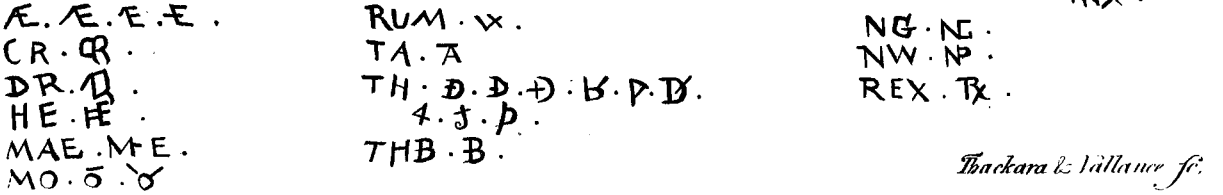

29.

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Abbreviations.

COL. AVR. KAR. COMM. P. F. Colonia Aurelia Karrhæ Commodiana Pia Felix, or Carneatum Commagene, or *Carrhæ in Asia.*

COL. B. A. Colonia Braccara Augusta, *Brague.*

COL. BRYT. L. V. Colonia Berytus Legio Quinta.

COL. CABE. Colonia Cabellio.

COL. CAES. AVG. Colonia Cæsarea Augusta, *in Palestine.*

COL. CAMALODVN. Colonia Camalodunum, *England.*

COL. CASILIN. Colonia Casilinum, *Castellazo in Italy.*

COL. CL. PTOL. Colonia Claudia Ptolemais, *Acre in Phœnicia.*

COL. DAMAS. METRO. Colonia Damascus Metropolis.

COL. F. I. A. P. BARCIN. Colonia Flavia Julia Augusta Pia, Barcino *or Barcelona.*

COL. FL. PAC. DEVLT. Colonia Flavia Pacensis Deultum, *Develtum in Thrace.*

COL. HA ME. T. Colonia Hadriana Mercurialis Thænitana, Mercuriali, *Fermo in Italy, and Thenes in Africa.*

COL H. (or HEL.) LEG. H. Colonia Heliopolis Legio Heliopolitana.

COL. HEL. I. O. M. H. Colonia Heliopolis Jovi Optimo Maximo Heliopolitano.

COL. IVL. AVG. C. I. F. COMAN. Colonia Julia Augusta Concordia Invicta Felix Comanorum, *drawn from Concordia in Italy, and sent to Comana in Cappadocia.*

COL. IVL. AVG. FEL. CREMNA. Colonia Julia Augusta Felix Cremna, *in Pamphylia.*

COL. IVL. CER. SAC. AVG. FEL. CAP. OECVM. ISE. HEL. Colonia Julia Certamen Sacrum, Augustum Felix Capitolinum Oecumenicum Iselasticum Heliopolitanum.

COL. IVL. CONC. APAM. AVG. D. D. Colonia Julia Concordia Apamea Augusta Decreto Decurionum.

COL. IVL. PATER. NAR. Colonia Julia Paterna Narbonensis.

COL. NEM. Colonia Nemausus.

COL. NICEPH. COND. Colonia Nicephorium Condita, *in Mesopotamia.*

COL. PATR. Colonia Patrensis *or* Patricia *Patrae in Greece,* or *Cordova in Spain.*

COL. P. F. AVG. F. CAES. MET. Colonia Prima Flavia Aug. Felix Cæsarea Metropolis, *in Palestine.*

COL. P. FL. AVG. CAES. METROP. PS. P. *same as above,* P. S. P. *is* Provinciæ Syriæ Palestinæ.

COL. PR. F. A. CAESAR. Colonia Prima Flavia Augusta Cæsaria *in Palestine.*

COL. R. F. AVG. FL. C. METROP. Colonia Romanv Felix Aug. Flavia Cæsarea Metropolis. *The same.*

COL. ROM. Colonia Romulea, or *Seville.*

COL. ROM. LVG. Colonia Romana Lugdunum.

COL. RVS. LEG. VI. Colonia Ruscino Legio Sexta, *Roussillon in France.*

COL. SABAR. Colonia Saburiæ.

COL. SABAS. Sebaste *in Palestine.*

COL. SER. G. NEAPOL. Colonia Servii Galbæ Neapolis, *in Palestine.*

COL. V. I. CELSA, or COL. VIC. IVL. CELSA. Colonia Victrix Julia Celsa, *Kelsa in Spain.*

COL. VIC. IVL. LEP. Colonia Victrix Julia Leptis, *in Africa.*

COL. VIM. AN. I. or II, &c. Colonia Viminacium Anno primo, *Widin in Servia.*

COL. VLP. TRA. Colonia Ulpia Trajana: *Kellen,* or *Warhal in Transilvania.*

CO. P. F. COE. METRO. Colonia Prima Flavia Cæsarea Metropolis.

CO. P. I. A. Colonia Pacenses Julia Augusta, *or* Col. Octaviana.

C. R. I F. S. Colonia Romani Julia Felix Sinope.

C. T. T. Colonia Togata Tarraco.

C. V. IL. Colonia Victrix Illice, *Elche in Spain.*

D. Decuriones.

D. C. A. Divus Cæs. Aug.

DERT. Dertosa.

GEN. COL. NER. PATR. Genio Coloniæ Neronianæ Patrensis.

G. L. S. Genio Loci Sacrum.

M. H. ILLERGAVONIA DRYT. Municipium Hibera Illergavonia Dertosa, *Tortosa in Catolonia.*

M. M. I. V. Municipes Municipii Julii Uticensis.

M. R. Municipium Ravennatium.

MVN. CAL. IVL. Municipium Calagurris Julia, *in Spain.*

MVN. CLVN. Municipium Clunia, *Crunna in Spain.*

MVN. FANE. ÆL. Municipium Fanestre Aelium. *Fano.*

MVN. STOB. Municipium Stobense, *Sobi in Macedon.*

MV. TV. Municipium Turiaso, *in Spain.*

N. TR. ALEXANDRIANAE COL. BOSTR. Nerviæ Trojanæ Alexandrianæ Coloniæ Bostræ, *in Palestine.*

SEP. COL. LAVD. Septimia Coloniæ Laudicea, *or* Laodicea.

SEP. TYR. MET. Septima Tyrus Metropolis.

Explanation of Plates.

Explanation of the Plates.

Fig. 1. A Persian Daric.
2. A drachm of Egina.
3. A silver hemidrachm of Alexander the Great.
4. Tigranes the younger of Armenia, with his sister.
5. One of the coins of the Arsacidæ of Parthia.
6. A coin of the Sassanidæ of Persia. First published by Mr Pinkerton.
7. Denarius of Cneius Pompey from Mr Pinkerton, reverse. Received by Spain.
8. A brass coin of Cunobelinus.
6. Pescennius Niger. Struck at Antioch; unique. In Dr Hunter's cabinet; published by Mr Pinkerton.
10. A silver coin of Carausius.
11. Reverse of Claudius in first brass.
12. Reverse of Adrian.
13. Of Antoninus Pius.
14. Of Commodus.
15. Of Severus.
16. A Saxon penny.
17. A Saxon styca.
18. 19. Ancient pennies, supposed to be Scottish.
20 A penny of William of Scotland.
21. A penny of Robert the Great.
22. An Irish penny.
23. The gold penny of Henry III.
24. The large noble of the first coinage of Edward III.
25. The gold medal of David II. of Scotland
26. The royal of Queen Mary of Scotland.
27. Letters on Anglo-Saxon coins.
28. Abbreviations on ditto,
29. Monentarius.

Mede. *Impressions of* MEDALS. See CASTING.

MEDALLION, or MEDALION, a medal of an extrordinary size supposed to be anciently struck by the emperors for their friends, and for foreign princes and ambassadors. But that the smallness of their number might not endanger the loss of the devices they bore, the Romans generally took care to stamp the subject of them upon their ordinary coins,

Medallions, in respect of the other coins, were the same as modern medals in respect of the modern money: they were exempted from all commerce, and had no other value than what was set upon them by the fancy of the owner. Medallions are so scarce, that there cannot be any set made of them, even though the metals and sizes should be mixed promiscuously.

MEDE (Joseph), a very learned English divine of the 17th century, was educated at Cambridge, and soon distinguished himself to great advantage; for by the time he had taken the degree of master of arts in 1610, he had made an uncommon progress in all academical studies. His first appearance as a writer was by an address to Dr Andrews, then bishop of Ely, in a Latin tract *De Sanctitate Relativa*, which was highly approved of by that prelate, who desired him to be his domestic chaplain. This Mr Mede very civilly refused; valuing the liberty of his studies above any hopes of preferment, and esteeming that freedom which he enjoyed in his cell, so he used to call it, as the haven of all his wishes. And indeed these thoughts had possessed him betimes; for when he was a school-boy, he was sent to by his uncle, Mr Richard Mede, a merchant, who, being then without children, offered to adopt him for his son if he would live with him; but he refused the offer, preferring, as it would seem, a life of study to a life of gain.

He was not chosen fellow of his college till after he was master of arts, and then not without the assistance of his friend bishop Andrews: for he had been passed over at several elections, on account of a causeless suspicion which Dr Cary, then master of the college, afterwards bishop of Exeter, had conceived of him, that "he looked too much towards Geneva." Being made fellow, he became an eminent and faithful tutor. After he had well grounded his pupils in humanity, logic, and philosophy, so that they were able to walk as it were alone, he used to set every one his daily task; which he rather chose, than to confine himself and them to precise hours for lectures. In the evening they all came to his chamber; and the first question he put to each was, *Quid dubitas?* "What doubts have you met with in your studies to-day?" For he supposed, that to doubt nothing and to understand nothing was just the same thing. This was right, and the best method to make young men exercise their rational powers, and not acquiesce in what they learn mechanically, and by rote, with an indolence of spirit which prepares them to receive and swallow implicitly whatever is offered to them. As to himself, he was so entirely devoted to the study of all excellent knowledge, that he made even the time he spent in his amusements serviceable to his purpose. He allowed himself little or no exercise but walking; and often, in the fields or college garden, would take occasion to speak of the beauty, signatures, virtues, or properties of the plants then in view, for he was a curious florist, an accurate herbalist, and thoroughly versed in the book of nature. The chief delight he took in company was to discourse with learned friends.

Mr Mede was a curious inquirer into the most abstruse parts of learning, and endeavoured after the knowledge of those things which were more remote from the vulgar track. Among other things, he spent no small pains and time in sounding the depths of astrology, and blotted much paper in calculating the nativities of his near relations and fellow-students: but this was in his younger years, and he afterwards discovered the vanity and weakness of this fanciful art. He applied himself to the more useful study of history and antiquities; particularly to those mysterious sciences which made the ancient Chaldeans, Egyptians, and other nations, so famous; tracing them as far as he could have any light to guide him in their oriental schemes and figurative expressions, as likewise in their hieroglyphics, not forgetting to inquire also into the oneirocritics of the ancients; which he did the rather, because of that affinity he conceived they might have with the language of the prophets. He was a curious and laborious searcher of antiquities relating to religion, ethnic, Jewish, Christian, and Mahometan: to which he added other attendants, necessary for understanding the more difficult parts of Scripture.

In 1620, he refused the provostship of Trinity-college, Dublin, into which he had been elected at the recommendation of archbishop Usher, who was his particular friend; as he did also when it was offered to him a second time, in 1630. The height of his ambition was, only to have had some small donative sinecure added to his fellowship, or to have been thrown into some place of quiet; where, retired from the noise and tumults of the world, and possessed of a competency of fortune, he might have been entirely at leisure for study and acts of piety. In the mean time, although his circumstances were scanty, for he had nothing but his fellowship and a college lecture, his charity was diffusive and uncommon; and, strange as it may now seem, he devoted the tenth of his income to pious and charitable uses. But his frugality and temperance always afforded him plenty. His prudence or moderation, either in declaring or defending his private opinions, was very remarkable; as was also his freedom from partiality, prejudice or prepossession, pride, anger, selfishness, flattery, and ambition. He was meek, patient, equally remote from superstition and licentiousness of thinking; and, in short possessed every virtue. This great and good man died in 1638, in his 52d year, having spent above two-thirds of his time in college.

MEDEA, in fabulous history, a celebrated sorceress, daughter of Æetes king of Colchis. Her mother's name, according to the more received opinion of Hesiod and Hyginus, was Idyia, or, according to others, Ephyre, Hecate, Asterodia, Antiope, and Neæra. She was the neice of Circe. When Jason came to Colchis in quest of the golden fleece, Medea became enamoured of him, and it was to her well-directed labours that the Argonauts owed their preservation. Medea had an interview with her lover in the temple of Hecate; when they bound themselves by the most solemn oaths to eternal fidelity. No sooner had Jason overcome all the difficulties which Æetes had placed in his way, than Medea embarked with the conquerors for

Greece. To ſtop the purſuit of her father, ſhe tore to pieces her brother Abſyrtus, and left his mangled limbs in the way through which Æetes was to paſs. This act of barbarity, ſome have attributed to Jaſon, and not to her. When Jaſon reached Iolchos his native country, the return and victories of the Argonauts were celebrated with univerſal rejoicings; but Æſon the father of Jaſon was unable to aſſiſt at the ſolemnity on account of the infirmities of his age. Medea, at her huſband's requeſt, removed the weakneſs of Æſon; and by drawing away the blood from his veins, and filling them again with the juice of certain herbs, ſhe reſtored him to the vigour and ſprightlineſs of youth. This ſudden change in Æſon aſtoniſhed the inhabitants of Iolchos; and the daughters of Pelias were deſirous to ſee their father reſtored by the ſame power to the vigour of youth. Medea, willing to revenge the injuries which her huſband's family had ſuffered from Pelias, increaſed their curioſity; and betrayed them into the murder of their father as preparatory to his rejuveneſcence, which ſhe afterwards refuſed to accompliſh. This action greatly irritated the people of Iolchos; and Medea with her huſband fled to Corinth to avoid their reſentment. Here they lived for 10 years with mutual attachment, when the love of Jaſon for Glauce the king's daughter interrupted their harmony, and Medea was divorced. Medea revenged the infidelity of Jaſon, by cauſing the death of Glauce, and the deſtruction of her family. She alſo killed two of her children in their father's preſence; and when Jaſon attempted to puniſh the barbarity of the mother, ſhe fled through the air upon a chariot drawn by winged dragons. From Corinth Medea came to Athens, where, after ſhe had undergone the neceſſary purification of her murder, ſhe married king Ægeus, or (according to others) lived in an adulterous manner with him. From her conduct with Ægeus, Medea had a ſon who was called *Medus*. Soon after, when Theſeus wiſhed to make himſelf known to his father, Medea, jealous of his fame and fearful of his power, attempted to poiſon him at a feaſt which had been prepared for his entertainment. Her attempts, however, failed of ſucceſs, and the ſight of the ſword which Theſeus wore by his ſide convinced Ægeus that the ſtranger againſt whoſe life he had ſo baſely conſpired was his own ſon. The father and the ſon were reconciled; and Medea, to avoid the puniſhment which her wickedneſs deſerved, mounted her fiery chariot and diſappeared through the air. She came to Colchis; where according to ſome, ſhe was reconciled to Jaſon, who had ſought her in her native country after her ſudden departure from Corinth. She died at Colchis, as Juſtin mentions, when ſhe had been reſtored to the confidence of her family. After death ſhe married Achilles in the Elyſian fields, according to the traditions mentioned by Simonides. The murder of Mimerus and Pheres, the youngeſt of Jaſon's children by Medea, is not to be attributed to the mother, according to Elian; but to the Corinthians, who aſſaſſinated them in the temple of Juno Acræa. To avoid the reſentment of the gods, and to deliver themſelves from the peſtilence which viſited their country after ſo horrid a maſſacre, they engaged the poet Euripides for five talents to write a tragedy, which cleared them of the murder, and repreſented Medea as the cruel aſſaſſin of her own children. And beſides, that this opinion might be the better credited, feſtivals were appointed, in which the mother was repreſented with all the barbarity of a fury murdering her own ſons.

MEDEOLA, CLIMBING AFRICAN ASPARAGUS, in botany: A genus of the hexandria order, belonging to the trigynia claſs of plants; and in the natural method ranking under the 11th order, *Sarmentaceæ*. There is no calyx; the corolla is ſexpartite and revoluted; the berry triſpermous. Its characters are theſe: The flower has no impalement; it has ſix oblong oval petals, and ſix awl-ſhaped ſtamina terminated by incumbent ſummits; and three horned germina terminating the ſtyle; the germina afterward turn to a roundiſh trifid berry with three cells, each containing one heart-ſhaped ſeed. There are two ſpecies.

MEDIA, now the province of GHILAN in Perſia, once the ſeat of a potent empire, was bounded according to Ptolemy, on the north by part of the Caſpain Sea; on the ſouth by Perſis, Suſiana, and Aſſyria; on the eaſt by Parthia and Hyrcania; and on the weſt by Armenia Major. It was anciently divided into ſeveral provinces, *viz.* Tropatene, Charomithrene, Darites, Marciane, Armariace, and Syro-Media. By a later diviſion, however, all theſe were reduced to two; the one called *Media Magna*, the other *Media Atropatia*, or ſimple *Atropatene*. Media Magna was bounded by Perſis, Parthia, Hyrcania, the Hyrcanian Sea, and Atropatene, and contained the cities of Ecbatan, Laodicea, Apamea, Raga, Rageia or Ragea, &c. Atropatene lay between the Caſpian mountains and the Caſpian Sea.

This country originally took its name from Madai, the third ſon of Japhet; as is plain from Scripture, where the Medes are conſtantly called *Medai*. Among profane authors, ſome derive the name *Media*, from one Medus the ſon of Jaſon and Medea; others from a city called *Media*. Sextus Rufus tells us that in his time it was called *Medena*, and from others we learn that it was alſo called *Aria*. The moſt probable hiſtory of the Medes is as follows.

This people lived in ſubjection to the Aſſyrians till the reign of Sennacherib, when they threw off the yoke, and lived for ſome time in a ſtate of anarchy. But at laſt, rapine and violence, the natural conſequences of ſuch a ſituation, prevailed ſo much that they were conſtrained to have recourſe to ſome kind of government, that they might be enabled to live in ſafety. Accordingly, about 699 B. C. one Dejoces having procured himſelf to be choſen king, united the ſcattered tribes into which the Medes were at that time divided; and having applied himſelf as much as poſſible to the civilization of his barbarous ſubjects, left the throne to his ſon Phraortes, after a reign of 53 years.

The new king, who was of a warlike and enterpriſing diſpoſition, ſubdued almoſt all the Upper Aſia lying between Mount Taurus and the river Halys which runs through Cappadocia into the Euxine Sea. Elated with this good ſucceſs, he invaded Aſſyria, the empire of which was now much declined, and greatly weakened by the revolt of many nations which had followed the example of the Medes. Nebuchodonoſor or Chyniladan, however, the reigning prince, having aſſembled what forces he could, engaged Phraortes, defeated, took him priſoner, and put him to death; after which, entering Media, he laid waſte the country, took the metropolis of Ecbatan itſelf, and levelled it with the ground.

Media

On the death of Phraortes, his ſon Cyaxares was placed on the throne. He was no leſs valiant and enterprising than his father, and had better ſucceſs againſt the Aſſyrians. With the remains of that army which had been defeated under his father, he not only drove the conquerors out of Media, but obliged Chyniladan to ſhut himſelf up in Nineveh. To this place he immediately laid cloſe ſiege; but was obliged to give over the enterprize on account of an irruption of the Scythians into his own country. Cyaxares engaged theſe new enemies with great reſolution; but was utterly defeated; and the conquerors over-ran not only all Media, but the greateſt part of Upper Aſia, extending their conqueſts into Syria, and as far as the confines of Egypt. They continued maſters of all this vaſt tract of country for 28 years, till at laſt Media was delivered from their yoke by a general maſſacre at the inſtigation of Cyaxares.

After this deliverance, the Medes ſoon repoſſeſſed themſelves of the territories they had loſt; and once more extended their frontiers to the river Halys, their ancient boundary to the weſtward. After this we find the Medes engaged in a war with the Lydians; which, however, ended without any remarkable tranſaction; but on the concluſion of it, Cyaxares having entered into a ſtrict alliance with Nebuchadnezzar king of Babylon, returned in conjunction with the Babylonians before Nineveh; which they took and levelled with the ground, putting moſt of the inhabitants to the ſword.

After this victory the Babylonian and Median empires ſeem to have been united: however, after, the death of Nebuchadnezzar, or rather in his lifetime, a war enſued, which was not extinguiſhed but by the diſſolution of the Babylonian empire. The Medes, under Aſtyages the ſon of Cyaxares I. withſtood the power of the Babylonian monarchs; and under Cyrus and Cyaxares II. utterly deſtroyed their empire by the taking of BABYLON, as is related under that article. After the death of Cyaxares, the kingdom fell to Cyrus, by whom the ſeat of the empire was transferred to PERSIA, under which article the hiſtory of Media now falls to be conſidered, as alſo the manners, &c. of the inhabitants.

Mediana | Medicinal.

MEDIANA, the name of a vein or little veſſel, made by the union of the cephalic and baſilic, in the bend of the elbow.

MEDIASTINUM, in anatomy, a double membrane, formed by a duplicature of the pleura; ſerving to divide the thorax and the lungs into two parts, and to ſuſtain the viſcera, and prevent their falling from one ſide of the thorax to the other. See ANATOMY, n° 117.

MEDIATE, or INTERMEDIATE, ſomething that ſtands betwixt and connects two or more terms conſidered as extremes; in which ſenſe it ſtands oppoſed to *immediate*.

MEDIATOR, a perſon that manages or tranſacts between two parties at variance in order to reconcile them. The word, in Scripture, is applied, 1. To Jeſus Chriſt, who is the only interceſſor and peace-maker between God and man, (1. Tim. ii. 5.) 2. to Moſes, who interpoſed between the Lord and his people, to declare unto them his word; (Deut. v. 5. iii. 19.)

MEDICAGO, SNAIL-TREFOIL, in botany: A genus of the decandria order, belonging to the diadelphia claſs of plants, and in the natural method ranking under the 32d order, *Papilionaceæ*. The legumen is compreſſed and ſcrewed; the carina of the corolla luring down from the vexillum. There are nine ſpecies, though only five are commonly cultivated in Britain. They are low trailing plants, adorned with ſmall yellow flowers, ſucceeded by ſmall, round, ſnail-ſhaped fruit, which are downy, and armed with a few ſhort ſpines. They are all eaſily propagated by ſeeds. For the properties and culture of LUCERN, a ſpecies of this genus, ſee AGRICULTURE, n° 183.

MEDICINAL, any thing belonging to medicine.

MEDICINAL Springs, a general name for any fountain, the waters of which are of uſe for removing certain diſorders. They are commonly either chalybeate or ſulphureous. See SPRINGS and WATER.

MEDICINE.

MEDICINE is the art of preventing, curing, or alleviating, thoſe diſeaſes to which the human ſpecies are ſubjected.

History of Medicine.

Origin of medicine among the Jews;

THE fabulous hiſtory of the ancients derives this art immediately from their gods; and, even among the moderns, ſome are of opinion that it may juſtly be conſidered as of divine revelation. But without adopting any ſuppoſition of which no probable evidence can be given, we may conclude that mankind were naturally led to it from caſual obſervations on the diſeaſes to which they found themſelves ſubjected; and that therefore, in one ſenſe at leaſt, it is as ancient as the human race. But at what period it began to be practiſed as an art, by particular individuals following it as a profeſſion, is not known. The moſt ancient phyſicians we read of were thoſe who embalmed the patriarch Jacob by order of his ſon Joſeph. The ſacred writer ſtyles theſe phyſicians *ſervants* to Joſeph: whence we may be aſſured that they were not *prieſts*, as the firſt phyſicians are generally ſuppoſed to have been; for in that age we know the Egyptian prieſts were in ſuch high favour, that they retained their liberty, when, through a public calamity, all the reſt of the people were made ſlaves to the prince.

It is not probable, therefore, that among the Egyptians religion and medicine were originally conjoined; and if we ſuppoſe the Jews not to have invented the art, but received it from ſome other nation, it is as little probable that the prieſts of that nation were their phyſicians as thoſe of Egypt.

That the Jewiſh phyſicians were abſolutely diſtinct from their prieſts, is very certain. Yet as the Jews reſided for ſuch a long time in Egypt, it is probable they would retain many of the Egyptian cuſtoms, from which it would be very difficult to free them. We read, however, that when king Aſa was diſeaſed in

Origin of Medicine.

in his feet, "he sought not to the Lord, but to the physicians." Hence we may conclude, that among the Jews the medicinal art was looked upon as a mere human invention; and it was thought that the Deity never cured diseases by making people acquainted with the virtues of this or that herb, but only by his miraculous power. That the same opinion prevailed among the heathens who were neighbours to the Jews, is also probable from what we read of Ahaziah king of Judah, who having sent messengers to inquire of Baal-zebub god of Ekron concerning his disease, he did not desire any remedy from him or his priests, but simply to know whether he should recover or not.

What seems most probable on this subject therefore is, that religion and medicine came to be mixed together only in consequence of that degeneracy into ignorance and superstition which took place among all nations. The Egyptians, we know, came at last to be sunk in the most ridiculous and absurd superstition; and then, indeed, it is not wonderful to find their priests commencing physicians, and mingling charms, incantations, &c. with their remedies. That this was the case, though long after the days of Joseph, we are very certain; and indeed it seems as natural for ignorance and barbarism to combine religion with physic, as it is for a civilized and enlightened people to keep them separate. Hence we see, that among all modern barbarians their priests or conjurors are their only physicians.

Among the Egyptians;

We are so little acquainted with the state of physic among the Egyptians, that it is needless to say much concerning them. They attributed the invention of medicine, as they did also that of many other arts, to Thoth, the HERMES or MERCURY of the Greeks. He is said to have writen many things in hieroglyphic characters upon certain pillars, in order to perpetuate his knowledge, and render it useful to others. These were transcribed by Agathodemon, or the second Mercury, the father of Tat, who is said to have composed books of them, that were kept in the most sacred places of the Egyptian temples. The existence of such a person, however, is very dubious, and many of the books ascribed to him were accounted forgeries as long ago as the days of Galen; there is also great reason to suspect that those books were written many ages after Hermes, and when physic had made considerable advances. Many of the books attributed to him are trifling and ridiculous; and though sometimes he is allowed to have all the honour of inventing the art, he is on other occasions obliged to share it with Osiris, Isis, and Apis or Serapis.

After all, the Egyptian physic appears to have been little else than a collection of absurd superstitions. Origen informs us, that they believed there were 36 demons, or gods of the air, who divided the human body among them; that they had names for all of them; and that by invoking them according to the part affected, the patient was cured. Of natural medicines we hear of none recommended by the father of Egyptian physic; except the herb *moly*, which he gave to Ulysses in order to secure him from the inchantments of Circe; and the herb *mercury*, of which he first discovered the use. His successors made use of venesection, cathartics, emetics, and clysters. There is no proof, however, that this practice was established by Hermes: on the contrary the Egyptians themselves pretend that the first hint of those remedies was taken from some observations on brute animals. Venesection was taught them by the hippopotamus, which is said to perform this operation upon itself. On these occasions, he comes out of the river, and strikes his leg against a sharp pointed reed. As he takes care to direct the stroke against a vein, the consequence must be a considerable effusion of blood; and this being suffered to run as long as the creature thinks proper, he at last stops up the orifice with mud. The hint of clysters was taken from the ibis, a bird which is said to give itself clysters with its bill, &c. They used venesection, however, but very little, probably on account of the warmth of the climate; and the exhibition of the remedies above-mentioned, joined with abstinence, formed the most of their practice.

3 Among the Greeks,

The Greeks too had several persons to whom they attributed the invention of physic, particularly Prometheus, Apollo or Pæan, and Æsculapius; which last was the most celebrated of any. But here we must observe, that as the Greeks were a very warlike people, their physic seems to have been little else than what is now called *surgery*, or the cure of wounds, fractures, &c. Hence Æsculapius, and his pupils Chiron, Machaon, and Podalirius, are celebrated by Homer only for their skill in curing these, without any mention of their attempting the cures of internal diseases. We are not, however, to suppose that they confined themselves entirely to surgery. They no doubt would occasionally prescribe for internal disorders; but as they were most frequently conversant with wounds, we may naturally suppose the greatest part of their skill to have consisted in knowing how to cure these. If we may believe the poets, indeed, the knowledge of medicine seems to have been very generally diffused. Almost all the heroes of antiquity are reported to have been physicians as well as warriors. Most of them were taught physic by the centaur Chiron. From him Hercules received instructions in the medical art, in which he is said to have been no less expert than in feats of arms. Several plants were called by his name; whence some think it probable that he found out their virtues, though others are of opinion that they bore the name of this renowned hero on account of their great efficacy in removing diseases. Aristæus king of Arcadia was also one of Chiron's scholars; and is supposed to have discovered the use of the drug called *silphium*, by some thought to be asafætida. Theseus, Telamon, Jason, Peleus, and his son Achilles, were all renowned for their knowledge in the art of physic. The last is said to have discovered the use of verdigris in cleansing foul ulcers. All of them, however, seem to have been inferior in knowledge to Palamades, who hindered the plague from coming into the Grecian camp after it had ravaged most of the cities of Hellespont, and even Troy itself. His method was to confine his soldiers to a spare diet, and oblige them to use much exercise.

The practice of these ancient Greek physicians, notwithstanding the praises bestowed on them by their poets, seems to have been very limited, and in some cases even pernicious. All the external remedies applied to Homer's wounded heroes were fomentations; while inwardly their physicians gave them wine, sometimes

Æsculapius.

mingled with cheese scraped down. A great deal of their physic also consisted in charms, incantations, amulets, &c. of which, as they are common to all superstitious and ignorant nations, it is superfluous to take any farther notice.

In this way the art of medicine continued among the Greeks for many ages. As its first professors knew nothing of the animal œconomy, and as little of the theory of diseases, it is plain, that whatever they did must have been in consequence of mere random trials, or empiricism, in the most strict and proper sense of the word. Indeed, it is evidently impossible that this or almost any other art could originate from another source than trials of this kind. Accordingly, we find, that some ancient nations were accustomed to expose their sick in temples, and by the sides of highways, that they might receive the advice of every one who passed. Among the Greeks, however, Æsculapius was reckoned the most eminent practitioner of his time, and his name continued to be revered after his death. He was ranked amongst the gods; and the principal knowledge of the medical art remained with his family to the time of Hippocrates, who reckoned himself the seventeenth in a lineal descent from Æsculapius, and who was truly the first who treated of medicine in a regular and rational manner.

5 Hippocrates.

Hippocrates, who is supposed to have lived 400 years before the birth of Christ, is the most ancient author whose writings expressly on the subject of the medical art are preserved; and he is therefore justly considered as the father of physic. All the accounts which we have prior to this time, if not evidently fabulous, are at the utmost highly conjectural. Even the medical knowledge of Pythagoras, so much celebrated as a philosopher, can hardly be considered as resting on any other foundation. But from the time of Hippocrates, medicine, separated from philosophy and religion, seems to have assumed the form of a science, and to have been practised as a profession. It may not, therefore, be improper to give a particular account of the state of medical knowledge as transmitted to us in his writings. The writings of Hippocrates, however, it may be remarked, are even more than preserved. Nor is it wonderful that attempts should have been made to increase the value of manuscripts, by attributing them to a name of such eminence. But although what are transmitted to us under the title of his works may have been written by different hands, yet the presumption is, that most, if not all of them, are of nearly as early a date, and contain the prevailing opinions of those times.

6 His writings.

According to the most authentic accounts, Hippocrates was a native of the island of Cos, and born in the beginning of the 88th Olympiad. In the writings transmitted to us as his, we find a general principle adopted, to which he gives the name of *Nature*. To this principle he ascribes a mighty power. "Nature (says he) is of itself sufficient to every animal. She performs every thing that is necessary to them, without needing the least instruction from any one how to do it." Upon this footing, as if nature had been a principle endowed with knowledge, he gives her the title of *just*; and ascribes virtues or powers to her, which are her servants, and by means of which she performs all her operations in the bodies of animals: and distributes the blood, spirits, and heat, through all parts of the body, which by these means receive life and sensation. And in other places he tells us, that it is this faculty which gives nourishment, preservation, and growth, to all things.

Hippocrates.

7 His idea of nature.

The manner in which nature acts, or commands her subservient power to act, is by attracting what is good and agreeable to each species, and by retaining, preparing, and changing it; and on the other side in rejecting whatever is superfluous or hurtful, after she has separated it from the good. This is the foundation of the doctrine of depuration, concoction, and crisis in fevers, so much insisted upon by Hippocrates and most other physicians. He supposed also, that every thing has an inclination to be joined to what agrees with it, and to remove from every thing contrary to it; and likewise that there is an affinity between the several parts of the body, by which they mutually sympathize with each other. When he comes to explain what this principle called *nature* is, he is obliged to resolve it into *heat*, which, he says, appears to have something immortal in it.

8 Of the causes of disease.

As far as he attempts to explain the causes of disease, he refers much to the humours of the body, particularly to the blood and the bile. He treats also of the effects of sleep, watchings, exercise, and rest, and all the benefit or mischief we may receive from them. Of all the causes of diseases, however, mentioned by Hippocrates, the most general are diet and air. On the subject of diet he has composed several books, and in the choice of this he was exactly careful; and the more so, as his practice turned almost wholly upon it. He also considered the air very much; he examined what winds blew ordinarily or extraordinarily; he considered the irregularity of the seasons, the rising and setting of stars, or the time of certain constellations; also the time of the solstices, and of the equinoxes; those days, in his opinion, producing great alterations in certain distempers.

9 His divisions of diseases.

He does not, however, pretend to explain how, from these causes, that variety of distempers arises which is daily to be observed. All that can be gathered from him with regard to this is, that the different cases abovementioned, when applied to the different parts of the body, produce a great variety of distempers. Some of those distempers he accounted *mortal*, others *dangerous*, and the rest easily *curable*, according to the cause from whence they spring and the parts on which they fall. In several places also he distinguishes diseases from the time of their duration, into *acute* or *short*, and *chronical* or *long*. He likewise distinguishes diseases by the particular places where they prevail, whether ordinary or extraordinary. The first, that is, those that are frequent and familiar to certain places, he called *endemic* diseases; and the latter, which ravaged extraordinarily sometimes in one place, sometimes in another, which seized great numbers at certain times, he called *epidemic*, that is, *popular* diseases; and of this kind the most terrible is the plague. He likewise mentions a third kind, the opposite of the former; and these he calls *sporadic*, or straggling diseases, these last include all the different sorts of distempers which invade at any one season, which are sometimes of one sort and sometimes of another.

Hippocrates.

another. He distinguished between those diseases which are hereditary, or born with us, and those which are contracted afterwards; and likewise between those of a *kindly* and such as are of a *malignant* nature, the former of which are easily and frequently cured, but the latter give the physicians a great deal of trouble, and are seldom overcome by all their care.

Hippocrates remarked four stages in distempers; viz. the beginning of the disease, its augmentation, its state or height, and its declination. In such diseases as terminate fatally, death comes in place of the declination. In the third stage, therefore, the change is most considerable, as it determines the fate of the sick person; and this is most commonly done by means of a *crisis*. By this word he understood any sudden change in sickness, whether for the better or for the worse, whether health or death succeed immediately. Such a change, he says, is made at that time by *nature*, either absolving or condemning the patient. Hence we may conclude, that Hippocrates imagined diseases to be only a disturbance of the animal economy, with which Nature was perpetually at variance, and using her utmost endeavours to expel the offending cause. Her manner of acting on these occasions is to reduce to their natural state those humours whose discord occasions the disturbance of the whole body, whether in relation to their quantity, quality, mixture, motion, or any other way in which they become offensive. The principal means employed by nature for this end is what Hippocrates calls *concoction*.

10 His opinion of a crisis.

By this he understood the bringing the morbific matter lodged in the humours to such a state, as to by easily fitted for expulsion by whatever means nature might think most proper. When matters are brought to this pass, whatever is superfluous or hurtful immediately empties itself, or nature points out to physicians the way by which such an evacuation is to be accomplished. The crisis takes place either by bleeding, stool, vomit, sweat, urine, tumors or abscesses, scabs, pimples, spots, &c. But these evacuations are not to be looked upon as the effects of a true crisis, unless they are in considerable quantity; small discharges not being sufficient to make a crisis. On the contrary, small discharges are a sign that nature is depressed by the load of humours, and that she lets them go thro' weakness and continual irritation. What comes forth in this manner is crude, because the distemper is yet too strong; and while matters remain in this state, nothing but a bad or imperfect crisis is to be expected. This shows that the distemper triumphs, or at least is equal in strength to nature, which prognosticates death, or a prolongation of the disease. In this last case, however, nature often has an opportunity of attempting a new crisis more happy than the former, after having made fresh efforts to advance the concoction of the humours.—It must here be observed, however, that, according to Hippocrates, concoction cannot be made but in a certain time, as every fruit has a limited time to ripen; for he compares the humours which nature has digested to fruits come to maturity.

The time required for concoction depends on the differences among distempers mentioned above. In those which Hippocrates calls *very acute*, the digestion or crisis happens by the fourth day, in those which are only *acute*, it happens on the seventh, 11th, or 14th day; which last is the longest period generally allowed by Hippocrates in distempers that are truly acute; though in some places he stretches it to the 20th, or 21st, nay, sometimes to the 40th or 60th days. All diseases that exceed this last term are called *chronical*. And while in those diseases that exceed 14 days, he considers every fourth day as critical, or at least remarkable, by which we may judge whether the crisis on the following fourth day will be favourable or not; so in those which run from 20 to 40 he reckons only the sevenths, and in those that exceed 40 he begins to reckon by 20. Beyond the 120th he thinks that the number of days has no power over the crisis. They are then referred to the general changes of the seasons; some terminating about the equinoxes; others about the solstices; others about the rising or setting of the stars of certain constellations; or if numbers have yet any place, he reckons by months, or even whole years. Thus (he says), certain diseases in children have their crisis in the seventh month after their birth, and others in their seventh or even their 14th year.

Though Hippocrates mentions the 21st as one of the critical days in acute distempers, as already noticed; yet, in other places of his works, he mentions also the 20th. The reason he gives for this in one of those places of his works is, that the days of sickness were not quite entire. In general, however, he is much attached to the odd days: insomuch that in one of his aphorisms he tells us, "The sweats that come out upon the 3d, 5th, 7th, 9th, 11th, 14th, 17th, 21st, 27th, 31st, or 34th days, are beneficial; but those that come out upon other days signify that the sick shall be brought low, that his disease shall be very tedious, and that he shall be subject to relapses." He further says, "That the fever which leaves the sick upon any but an odd day is usually apt to relapse." Sometimes, however, he confesses that it is otherwise; and he gives an instance of a salutary crisis happening on the sixth day. But these are very rare instances, and therefore cannot, in his opinion, overthrow the general rule.

Besides the crisis, however, or the change which determines the fate of the patient, Hippocrates often speaks of another, which only changes the species of the distemper, without restoring the patient to health; as when a vertigo is turned to an epilepsy, a tertian fever to a quartan, or to a continual, &c.

11 His accuracy in prognostics;

But what has chiefly contributed to procure the vast respect generally paid to Hippocrates is his industry in observing the most minute circumstances of diseases, and his exactness in nicely describing every thing that happened before, and every accident that appeared at the same time with them; and likewise what appeared to give ease, and what to increase the malady: which is what we call *writing the history of a disease*.—Thus he not only distinguished one disease from another by the signs which properly belonged to each; but by comparing the same sort of distemper which happened to several persons, and the accidents which usually appeared before and after, he could often foretel a disease before it came, and afterwards give a right judgment of the event of it. By this way of prognosticating, he came to be exceedingly admired;

Hippocrates.

admired: and this he carried to ſuch a height, that it may be juſtly be ſaid to be his maſter-piece; and Celſus, who lived after him, remarks, that ſucceeding phyſicians, though they found out ſeveral new things relating to the management of diſeaſes, yet were obliged to the writings of Hippocrates for all that they knew of ſigns.

From the look;

The firſt thing Hippocrates conſidered, when called to a patient, was his looks.—It was a good ſign with him to have a viſage reſembling that of a perſon in health, and the ſame with what the ſick man had before he was attacked by the diſeaſe. As it varied from this, ſo much the greater danger was apprehended. The following is the deſcription which he gives of the looks of a dying man.—"When a patient (ſays he) has his noſe ſharp, his eyes ſunk, his temples hollow, his ears cold and contracted, the ſkin of his forehead tenſe and dry, and the colour of his face tending to a pale-green, or lead colour, one may give out for certain that death is very near at hand; unleſs the ſtrength of the patient has been exhauſted all at once by long watchings, or by a looſeneſs, or being a long time without eating." This obſervation has been confirmed by thoſe of ſucceeding phyſicians, who have, from him, denominated it the *Hippocratic face*. The lips hanging relaxed and cold, are likewiſe looked upon by this author as a confirmation of the foregoing prognoſtic. He took alſo his ſigns from the diſpoſition of the eyes in particular. When a patient cannot bear the light: when he ſheds tears involuntarily; when, in ſleeping, ſome part of the white of the eye is ſeen, unleſs he uſually ſleeps after that manner, or has a looſeneſs upon him: theſe ſigns, as well as the foregoing ones, prognoſticate danger. The eyes deadened, as it were with a miſt ſpread over them, or their brightneſs loſt, likewiſe preſages death, or great weakneſs. The eyes ſparkling, fierce, and fixed, denote the patient to be delirious, or that he ſoon will be ſeized with a frenzy. When the patient ſees any thing red, and like ſparks of fire and lightning paſs before his eyes, you may expect an hæmorrhagy; and this often happens before thoſe criſes which are to be attended by a loſs of blood.

From the poſture in bed;

The condition of the patient is alſo ſhown by his poſture in bed. If you find him lying on one ſide, his body, neck, legs, and arms, a little contracted, which is the poſture of a man in health, it is a good ſign: on the contrary, if he lies on his back, his arms ſtretched out, and his legs hanging down, it is a ſign of great weakneſs; and particularly when the patient ſlides or lets himſelf fall down towards the feet, it denotes the approach of death. When a patient in a burning fever is continually feeling about with his hands and fingers, and moves them up before his face and eyes as if he was going to take away ſomething that paſſed before them; or on his bed-covering, as if he was picking or ſearching for little ſtraws, or taking away ſome filth, or drawing out little flocks of wool; all this is a ſign that he is delirious, and that he will die. Among the other ſigns of a preſent or approaching delirium he alſo adds this: When a patient who naturally ſpeaks little begins to talk more than he uſed to do, or when one that talks much becomes ſilent, this change is to be reckoned a ſort of delirium, or is a ſign that the patient will ſoon fall into one. The frequent trembling or ſtarting of the tendons of the wriſt, preſage likewiſe a delirium. As to the different ſorts of delirium, Hippocrates is much more afraid of thoſe that run upon mournful ſubjects, than ſuch as are accompanied with mirth.

From reſpiration;

When a patient breathes faſt, and is oppreſſed, it is a ſign that he is in pain, and that the parts above the diaphragm are inflamed. Breathing long, or when the patient is a great while in taking his breath, ſhows him to be delirious; but eaſy and natural reſpiration is always a good ſign in acute diſeaſes. Hippocrates depended much on reſpiration in making his prognoſtics; and therefore has taken care in ſeveral places to deſcribe the different manner of a patient's breathing. Continual watchings in acute diſeaſes, are ſigns of preſent pain, or a delirium near at hand.

From excrementitious diſcharges.

Hippocrates alſo drew ſigns from all excrements, whatever they are, that are ſeparated from the body of man. His moſt remarkable prognoſtics, however, were from the urine. The patient's urine, in his opinion, is beſt when the ſediment is white, ſoft to the touch, and of an equal conſiſtence. If it continue ſo during the courſe of the diſtemper, and till the time of the criſis, the patient is in no danger, and will ſoon be well. This is what Hippocrates called *concocted urine*, or what denotes the concoction of the humours; and he obſerved, that this concoction of the urine ſeldom appeared thoroughly, but on the days of the criſis which happily put an end to the diſtemper. "We ought (ſaid Hippocrates) to compare the urine with the purulent matter which runs from ulcers. As the pus, which is white, and of the ſame quality with the ſediment of the urine we are now ſpeaking of, is a ſign that the ulcer is on the point of cloſing; ſo that which is clear, and of another colour than white, and of an ill ſmell, is a ſign that the ulcer is virulent, and in the ſame manner difficult to be cured: the urines that are like this we have deſcribed are only thoſe which may be named good; all the reſt are ill, and differ from one another only in the degrees of more and leſs. The firſt never appear but when nature has overcome the diſeaſe; and are a ſign of the concoction of humours, without which you cannot hope for a certain cure. On the contrary, the laſt are made as long as the crudity remains, and the humours continue unconcocted. Among the urines of this laſt ſort, the beſt are reddiſh, with a ſediment that is ſoft, and of an equal conſiſtence; which denotes, that the diſeaſe will be ſomewhat tedious, but without danger. The worſt are thoſe which are very red, and at the ſame time clear and without ſediment; or that are muddy and troubled in the making. In urine there is often a ſort of cloud hanging in the veſſel in which it is received; the higher this riſes, or the farther diſtant it is from the bottom, or the more different from the colour of the laudable ſediment abovementioned, the more there is of crudity. That which is yellow, or of a ſandy colour, denotes abundance of bile; that which is black is the worſt, eſpecially if it has an ill ſmell, and is either altogether muddy or altogether clear. That whoſe ſediment is like large ground wheat or little flakes or ſcales ſpread one upon another, or bran, preſages ill, eſpecially the laſt. The fat or oil that ſometimes ſwims upon the top of the urine, and appears in a form ſomething like a ſpider's web, is a ſign

Urine.

of

Hippocrates.

of a consumption of the flesh and solid parts. The making of a great quantity of urine is the sign of a crisis, and sometimes the quality of it shows how the bladder is affected. We must also observe, that Hippocrates compared the state of the tongue with the urine; that is to say, when the tongue was yellow, and charged with bile, the urine he knew must of course be of the same colour; and when the tongue was red and moist, the urine was of its natural colour.

Fœces.

His prognostics for the excretions by stool are as follow. Those that are soft, yellowish, of some consistence, and not of an extraordinary ill smell, that answer to the quantity of what is taken inwardly, and that are voided at the usual hours, are the best of all. They ought also to be of a thicker consistence when the distemper is near the crisis; and it ought to be taken for a good prognostic, when some worms, round and long, are evacuated at the same time with them. The prognosis, however, may still be favourable, though the matter excreted be thin and liquid, provided it make not to much noise in coming out, and the evacuation be not in a small quantity nor to often: nor in so great abundance, nor so often as to make the patient faint. All matter that is watery, white, of a pale green, or red, or frothy and viscous, is bad. That which is blackish, or of a lived hue, is the most pernicious. That which is pure black, and nothing else but a discharge of black bile, always prognosticates very ill; this humour, from what part soever it comes, showing the ill disposition of the intestines. The matter that is of several different colours, denotes the length of the distemper; and, at the same time, that it may be of dangerous consequence. Hippocrates places in the same class the matter that is bilious or yellow, and mixed with blood, or green and black, or like the dregs or scrapings of the guts. The stools that consist of pure bile, or entirely of phlegm, he also looks upon to be very bad.

Matter cast up by vomiting ought to be mixed with bile and phlegm; where one of these humours only is observed, it is worse. That which is black, livid, green, or of the colour of a leek, indicates alarming consequences. The same is to be said of that which smells very ill; and if at the same time it be livid, death is not far off. The vomiting of blood is very often mortal.

Expectoration.

The spittings which give ease in diseases of the lungs and in pleurisies, are those that come up readily and without difficulty; and it is good if they be mixed at the beginning with much yellow: but if they appear of the same colour, or are red, a great while after the beginning of the distemper, are salt and acrimonious, and cause violent coughings, they are not good. Spittings purely yellow are bad; and those that are white, viscous, and frothy, give no ease. Whiteness is a good sign of concoction in regard to spittings; but they ought not at all to be viscous, nor too thick, nor too clear. We may make the same judgment of the excrements of the nose according to their concoction and crudity. Spittings that are black, green, and red, are of very bad consequence. In inflammations of the lungs, those that are mixed with bile and blood presage well if they appear at the beginning, but are bad if they arise not about the seventh day. But the worst sign in these distempers is, when there is no expectoration at all, and the too great quantity of matter that is ready to be discharged this way makes a rattling in the breast. After spitting of blood, the discharge of purulent matter often follows, which brings on a consumption, and at last death.

Sweats.

A kind good sweat is that which arises on the day of the crisis, and is discharged in abundance all over the body, and at the same time from all parts of the body, and thus carries off the fever: A cold sweat is alarming, especially in acute fevers, for in others it is only a sign of long continuance. When the patient sweats no where but on the head and neck, it is a sign that the disease will be long and dangerous. A gentle sweat in some particular part, of the head and breast, for instance, gives no relief, but denotes the seat of the distemper, or the weakness of the part. This kind of sweat was called by Hippocrates *ephidrosis*.

The hypochondria, or the abdomen in general, ought always to be soft and even, as well on the right side as on the left. When there is any hardness or unevenness in those parts, or heat and swellings, or when the patient cannot endure to have it touched, it is a sign the intestines are indisposed.

From the pulse.

Hippocrates also inquired into the state of the pulse, or the beating of the arteries. The most ancient physicians, however, and even Hippocrates himself, for a long time, by this word understood the violent pulsation that is felt in that inflamed part, without putting the fingers to it. It is observed by Galen, and other physicians, that Hippocrates touches on the subject of the pulse more slightly than any other on which he treats. But that our celebrated physician understood something even on this subject, is easily gathered from several passages in his writings; as when he observes, that in acute fevers the pulse is very quick and very great; and when he makes mention, in the same place, of trembling pulses, and those that beat slowly; when he observes, that in some diseases incident to women, when the pulse strikes the finger faintly, and in a languishing manner, it is a sign of approaching death. He remarks also, in the *Coacæ Prænotiones*, that he whose vein, that is to say, whose artery of the elbow, beats, is just going to run mad, or else that the person is at that time very much under the influence of anger.

From this account of Hippocrates, it will appear, that he was not near so much taken up with reasoning on the phenomena of diseases, as with reporting them. He was content to observe these phenomena accurately, to distinguish diseases by them, and judged of the event by comparing them exactly together. For his skill in prognostics he was indeed very remarkable, as we have already mentioned, insomuch that he and his pupils were looked upon by the vulgar as prophets. What adds very much to his reputation is, that he lived in an age when physic was altogether buried in superstition, and yet he did not suffer himself to be carried away by it; on the contrary, on many occasions, he expresses his abhorrence of it.

Having thus seen in what Hippocrates makes the difference between health and sickness to consist, and likewise the most remarkable signs from whence he drew his prognostics, we must now consider the means he prescribed for the preservation of health, and the cure of diseases. One of his principal maxims was this,

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this, That, to preſerve health, we ought not to overcharge ourſelves with too much eating, nor neglect the uſe of exerciſe and labour. In the next place, That we ought by no means to accuſtom ourſelves to too nice and exact a method of living; becauſe thoſe who have once begun to act by this rule, if they vary in the leaſt from it, find themſelves very ill; which does not happen to thoſe who take a little more liberty, and live ſomewhat more irregularly. Notwithſtanding this he does not not neglect to inquire diligently into what thoſe who were in health uſed for food in his time. Here we cannot help taking notice of the prodigious diſparity between the delicacy of the people in our days and in thoſe of Hippocrates: for he takes great pains to tell the difference between the fleſh of a dog, a fox, a horſe, and an aſs; which he would not have done if at that time they had not been uſed for victuals, at leaſt by the common people. Beſides theſe, however, Hippocrates ſpeaks of all other kinds of proviſion that are now in uſe; for example, ſalads, milk, whey, cheeſe, fleſh as well of birds as of four-footed beaſts, freſh and ſalt fiſh, eggs, all kinds of pulſe, and the different kinds of grain we feed on, as well as the different ſorts of bread that are made of it. He alſo ſpeaks very often of a ſort of liquid food, or broth, made of barley-meal, or ſome other grain, which they ſteeped for ſome time, and then boiled in water. With regard to drink, he takes a great deal of pains to diſtinguiſh the good waters from the bad. The beſt, in his opinion, ought to be clear, light, without ſmell or taſte, and taken out of the fountains that turn towards the eaſt. The ſalt-waters, thoſe that he calls hard, and thoſe that riſe out of fenny ground, are the worſt of all; he condemns alſo thoſe that come from melted ſnow. But though Hippocrates makes all thoſe diſtinctions, he adviſes thoſe who are in health to drink of the firſt water that comes in their way. He ſpeaks alſo of alum waters, and thoſe that are hot; but does not enlarge upon their qualities. He adviſes to mix wine with an equal quantity of water: and this (he ſays) is the juſt proportion; by uſing which the wine will expel what is hurtful to the body, and the water will ſerve to temper the acrimony of the humours.

12 His maxims for the preſervation of health.

Diet.

Exerciſe.

For thoſe that are in health, and likewiſe for ſuch as are ſick, Hippocrates adviſes exerciſe. The books, however, which treat on this ſubject, M. Le Clerk conjectures to have been written by Herodicus, who firſt introduced gymnaſtic exerciſe into medicine, and who is ſaid by Hippocrates himſelf to have killed ſeveral people by forcing them to walk while they were afflicted with fevers and other inflammatory diſorders. The advices given in them conſiſt moſtly in directions for the times in which we ought to walk, and the condition we ought to be in before it; when we ought to walk ſlowly, and when to run, &c.; and all this with reſpect to different ages and temperaments, and with deſign to bring the body down, or diſſipate the humours. Wreſtling, although a violent exerciſe, is numbered with the reſt. In the ſame place alſo mention is made of a play of the hands and fingers, which was thought good for health, and called *chironomie*; and of another diverſion which was performed round a ſort of ball hung up, which they called *corycus*, and which they ſtruck forward with both their hands.

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Excretions.

With regard to theſe things which ought to be ſeparated from, or retained in the human boby, Hippocrates obſerves, that people ought to take great care not to load themſelves with excrements, or keep them in too long; and beſides the exerciſe abovementioned, which carries off one part of them, and which he preſcribed chiefly on this account, he adviſes people to excite and rouſe up nature when ſhe flagged, and did not endeavour to expel the reſt, or take care of the impediments by which ſhe was reſiſted. For this reaſon he preſcribed meats proper for looſening the belly; and when theſe were not ſufficient, he directed the uſe of clyſters and ſuppoſitories. For thin and emaciated perſons he directed clyſters compoſed only of milk and oily unctuous ſubſtances which they mixed with a decoction of chick-peaſe; but for ſuch as were plethoric, they only made uſe of ſalt or ſea-water.

As preſervative againſt diſtempers, Hippocrates alſo adviſed the uſe of vomits, which he directed to be taken once or twice a month during the time of winter and ſpring. The moſt ſimple of theſe were made of a decoction of hyſop, with an addition of a little vinegar and ſalt. He made thoſe that were of a ſtrong and vigorous conſtitution take this liquor in a morning faſting; but ſuch as were thin and weakly took it after ſupper.—Venery, in his opinion, is wholeſome, provided people conſult their ſtrength, and do not purſue it to exceſs; which he finds fault with on all occaſions, and would have exceſs avoided alſo in relation to ſleep and watching. In his writings are likewiſe to be found ſeveral remarks concerning good and bad air; and he makes it appear that the good or bad diſpoſition of this element does not depend ſolely on the difference of the climate, but on the ſituation of every place in particular. He ſpeaks alſo of the good and bad effects of the paſſions, and recommends moderation in regard to them.

From what we have already related concerning the opinions of Hippocrates, it may naturally be concluded, that for the moſt part he would be contented with obſerving what the ſtrength of nature is able to accompliſh without being aſſiſted by the phyſician. That this was really the caſe, may be eaſily perceived from a peruſal of his books entitled, "Of epidemical diſtempers;" which are, as it were, journals of the practice of Hippocrates; for there were find him often doing nothing more than deſcribing the ſymptoms of a diſtemper, and informing us what has happened to the patient day after day, even to his death or recovery, without ſpeaking a word of any kind of remedy. Sometimes, however, he did indeed make uſe of remedies; but theſe were exceedingly ſimple and few, in compariſon of what have been given by ſucceeding practitioners. Theſe remedies we ſhall preſently conſider after we have given an abridgment of the principal maxims on which his practice is founded.

13 His maxims for the cure of diſeaſe.

Hippocrates aſſerted in the firſt place, That contraries, or oppoſites, are the remedies for each other; and this maxim he explains by an aphoriſm; in which he ſays, that evacuations cure thoſe diſtempers which come from repletion, and repletion thoſe that are cauſed

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ſed by evacuation. So heat is deſtroyed by cold, and cold by heat, &c. In the ſecond place, he aſſerted, that phyſic is an addition of what is wanting, and a ſubtraction or retrenchment of what is ſuperfluous: an axiom which is explained by this, viz. that there are ſome juices or humours, which in particular caſes ought to be evacuated, or driven out of the body, or dried up; and ſome others which ought to be reſtored to the body, or cauſed to be produced there again. As to the method to be taken for this addition or retrenchment, he gives this general caution, That you ought to be careful how you fill up, or evacuate, all at once, or too quickly, or too much; and that it is equally dangerous to heat or cool again on a ſudden; or rather, you ought not to do it: every thing that runs to an exceſs being an enemy to nature. In the fourth place, Hippocrates allowed that we ought ſometimes to dilate, and ſometimes to lock up: to dilate, or open the paſſages by which the humours are voided naturally, when they are not ſufficiently opened, or when they are cloſed; and, on the contrary, to lock up or ſtraiten the paſſages that are relaxed, when the juices that paſs there ought not to paſs, or when they paſs in too great quantity. He adds, that we ought ſometimes to ſmooth, and ſometimes to make rough: ſometimes to harden, and ſometimes to ſoften again; ſometimes to make more fine or ſupple; ſometimes to thicken; ſometimes to rouſe up, and at other times to ſtupify or take away the ſenſe; all in relation to the ſolid parts of the body, or to the humours. He gives alſo this farther leſſon, That we ought to have regard to the courſe the humours take, from whence they come, and whither they go; and in conſequence of that, when they go where they ought not, that we make them take a turn about, or carry them another way, almoſt like the turning the courſe of a river: or, upon other occaſions, that we endeavour if poſſible to recal, or make the ſame humours return back again; drawing upward ſuch as have a tendency downward, and drawing downward ſuch as tend upward. We ought alſo to carry off, by convenient ways, that which is neceſſary to be carried off; and not let the humours once evacuated enter into the veſſels again. Hippocrates gives alſo the following inſtruction, That when we do any thing according to reaſon, though the ſucceſs be not anſwerable, we ought not too eaſily, or too haſtily, to alter the manner of acting, as long as the reaſons for it are yet good. But as this maxim might ſometimes prove deceitful, he gives the following as a corrector to it: "We ought (ſays he) to mind with a great deal of attention what gives eaſe, and what creates pain; what is eaſily ſupported, and what cannot be endured." We ought not to do any thing raſhly; but ought often to pauſe, or wait, without doing any thing: by this way, if you do the patient no good, you will at leaſt do him no hurt.

Theſe are the principal and moſt general maxims of the practice of Hippocrates, and which proceed upon the ſuppoſition laid down at the beginning, viz. that nature cures diſeaſes. We next proceed to conſider particularly the remedies employed by him, which will ſerve to give us further inſtructions concerning his practice.

14 His maxims reſpecting diet.

Diet was the firſt, the principal, and often the only remedy made uſe of by this great phyſician to anſwer the greateſt part of the intentions abovementioned: by means of it he oppoſed moiſt to dry, hot to cold, &c.; and what he looked upon to be the moſt conſiderable point was, that thus he ſupported nature, and aſſiſted her to overcome the malady. The dietetic part of medicine was ſo much the invention of Hippocrates himſelf, that he was very deſirous to be accounted the author of it; and the better to make it appear that it was a new remedy in his days, he ſays expreſsly, that the ancients had wrote almoſt nothing concerning the diet of the ſick, having omitted this point, though it was one of the moſt eſſential parts of the art.

15 Diet in acute diſeaſes.

The diet preſcribed by Hippocrates for patients labouring under acute diſtempers, differed from that which he ordered for thoſe afflicted with chronical ones. In the former, which require a more particular exactneſs in relation to diet, he preferred liquid food to that which was ſolid, eſpecially in fevers. For theſe he uſed a ſort of broth made of cleanſed barley; and to this he gave the name of *ptiſan*. The manner in which the ancients prepared a ptiſan was as follows: They firſt ſteeped the barley in water till it was plumped up; and afterwards they dried it in the ſun, and beat it to take off the huſk. They next ground it; and having let the flour boil a long time in the water, they put it out into the ſun, and when it was dry they preſſed it cloſe. It is properly this flour ſo prepared that is called *ptiſan*. They did almoſt the ſame thing with wheat, rice, lentils, and other grain: but they gave theſe ptiſans the name of the grain from whence they were extracted, as *ptiſan of lentils, rice*, &c. whereas the ptiſan of barley was called ſimply *ptiſan*, on account of the excellency of it. When they wanted to uſe it, they boiled one part of it in 10 or 15 of water; and when it began to grow plump in boiling, they added a little vinegar, and a very ſmall quantity of aniſe or leek, to keep it from clogging or filling the ſtomach with wind. Hippocrates preſcribes this broth for women that have pains in their belly after delivery. "Boil ſome of this ptiſan (ſays he), with ſome leek, and the fat of a goat, and give it to the woman in bed." This will not be thought very ſingular, if we reflect on what has been hinted above concerning the indelicate manner of living in thoſe times. He preferred the ptiſan to all other food in fevers, becauſe it ſoftened and moiſtened much, and was beſides of eaſy digeſtion. If he was concerned in a continual fever, he would have the patient begin with a ptiſan of a pretty thick conſiſtence, and go on by little and little, leſſening the quantity of barley-flour as the height of the diſtemper approached; ſo that he did not feed the patient but with what he called the *juice of the ptiſan*; that is, the ptiſan ſtrained, where there was but very little of the flour remaining, in order that nature being diſcharged in part from the care of digeſting the aliments, ſhe might the more eaſily hold out to the end, and overcome the diſtemper, or the cauſe of it. With regard to the quantity, he cauſed the ptiſan to be taken twice a-day by ſuch patients as in health uſed to take two meals a-day, not thinking it convenient that thoſe who were ſick would eat oftener than when they were well. He alſo would not allow eating twice a-day to thoſe who eat but once in that time when in health. In the paroxyſm of a

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fever he gave nothing at all; and in all distempers where there are exacerbations, he forbid nourishment while the exacerbations continued. He let children eat more; but those who were grown up to man's estate, or were of an advanced age, less; making allowance, however, for the custom of each particular person, or for that of the country.

But though he was of opinion that too much food ought not to be allowed to the sick, he was not of the mind of some physicians who prescribed long abstinence, especially in the beginning of fevers. The reason he gave for this was, that the contrary practice weakened the patients too much during the first days of the distemper, by which means their physicians were obliged to allow them more food when the illness was at its height, which in his opinion was improper. Besides, in acute distempers, and particularly in fevers, Hippocrates made choice of refreshing and moistening nourishment; and amongst other things prescribed orange, melon, spinach, gourd, and dock. This sort of food he gave to those that were in a condition to eat, or could take something more than a ptisan.

Drink.

The drink he commonly gave to his patients was made of eight parts of water and one of honey. In some distempers they added a little vinegar; but besides these, they had another sort named κυκεων, or *mixture*. One prescription of this sort we find intended for a consumptive person; it consisted of rue, anise, celery, coriander, juice of pomegranate, the roughest red wine, water, flour of wheat and barley, with old cheese made of goats milk. Hippocrates did not approve of giving plain water to the sick; but though he generally prescribed the drinks abovementioned, he did not absolutely forbid the use of wine, even in acute distempers and fevers, provided the patients were not delirious nor had pains in their head. Besides, he took care to distinguish the wines proper in these cases: preferring to all other sorts white wine that is clear and has a great deal of water, with neither sweetness nor flavour.

16 Diet in chronic diseases.

These are the most remarkable particulars concerning the diet prescribed by Hippocrates in acute distempers; in chronical ones he made very much use of milk and whey; though we are not certain whether this was done on account of the nourishment expected from them, or that he accounted them medicines.

17 His maxims respecting bathing.

There were many diseases for which he judged the bath was a proper remedy; and he takes notice of all the circumstances that are necessary in order to cause the patient receive benefit from it, among which the following are the principal. The patient that bathes himself must remain still and quiet in his place without speaking while the assistants throw water over his head or are wiping him dry; for which last purpose he desired them to keep sponges, instead of that instrument called by the ancients *strigil*, which served to rub off from the skin the dirt and nastiness left upon it by unguents and oils with which they anointed themselves. He must also take care not to catch cold; and must not bathe immediately after eating and drinking, nor eat or drink immediately after coming out of the bath. Regard must also be had whether the patient has been accustomed to bathe while in health, and whether he has been benefited or hurt by it. Lastly, he must abstain from the bath when the body is too open, or too costive, or when he is too weak; or if he has an inclination to vomit, a great loss of appetite, or bleeds at the nose. The advantage of the bath, according to Hippocrates, consists in moistening and refreshing, taking away weariness, making the skin soft and the joints pliant; in provoking urine, making the nostrils open, and opening the other excretories. He allows two baths in a day to those who have been accustomed to it in health.

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18 His maxims respecting exercise.

In chronical distempers Hippocrates approved very much of exercise, though he did not allow it in acute ones: but even in these he did not think that a patient ought always to lie a-bed; but tells us, that "we must sometimes push the timorous out of bed, and rouse up the lazy."

19 His maxims respecting purgation.

When he found that diet and exercise were not sufficient to ease nature of a burden of corrupted humours, he was obliged to make use of other means, of which *purgation* was one. By this word he understood all the contrivances that are made use of to discharge the stomach and bowels; though it commonly signifies only the evacuation by the belly by stool. This evacuation he imagined to be occasioned by the purgative medicines attracting the humours to themselves. When first taken into the body, he thought they attracted that humour which was most similar to them, and then the others, one after another.—Most of the purgatives used in his time were emetics also, or at least were very violent in their operation downwards. These were the white and black hellebore; the first of which is now reckoned among the poisons. He caused also the Cnidian berries, which are nothing else but the seeds of thymelea or chamælea; cneorum peplium, which is a sort of milk-thistle; thapsia; the juice of hippophaë, a sort of rhamnus; elaterium, or juice of the wild cucumber; flowers of brass, coloquintida, scammony, the magnesian stone, &c.

As these purgatives were all very strong, Hippocrates was extremely cautious in their exhibition. He did not prescribe them in the dog-days; nor did he ever purge women with child, and very seldom children or old people. He principally used purgatives in chronical distempers: but was much more wary in acute ones. In his books entitled "Of Epidemical Distempers," there are very few patients mentioned to whom he gave purgative medicines. He also takes notice expressly, that these medicines having been given in cases of the distempers of which he was treating, had produced very bad effects. We are not, however, from this to conclude, that Hippocrates absolutely condemned purging in acute distempers; for in some places he expressly mentions his having given them with success. He was of opinion, for instance, that purging was good in a pleurisy when the pain was seated below the diaphragm; and in this case he gave black hellebore, or some peplium mixed with the juice of *laserpitium*, which is supposed to have been our asafætida.

The principal rule Hippocrates gives with relation to purging is, that we ought only to purge off the humours that are concocted, and not those that are yet crude, taking particular care not to do it at the beginning of the distemper, least the humours should be

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be disturbed or stirred up, which happens pretty often. He was not, however, the first who remarked that it would be of ill consequence to stir the humours in the beginning of an acute distemper. The Egyptian physicians had before observed the same thing. By the *beginning* of a distemper, Hippocrates understood all the time from the first day to the fourth complete.

Hippocrates imagined that each purgative medicine was adapted to the carrying off some particular humour; and hence the distinction of purgatives into hydragogue, cholagogue, &c. which is now justly exploded. In consequence of this notion, which prevailed long after his time, he pretended that we knew if a purgative had drawn from the body what was fit to be evacuated according as we found ourselves well or ill upon it. If we found ourselves well, it was a sign that the medicine had effectually expelled the offending humour. On the contray, if we were ill, he imagined, whatever, quantity of humour came away, that the humour which caused the illness still remained; not judging of the goodness or badness of a purge by the quantity of matters that were voided by it, but by their quality and the effect that followed after it.

Vomits were also pretty much used as medicines by Hippocrates. We have already seen what those were which he prescribed to people in health by way of preventatives. With regard to the sick, he sometimes advised them to the same, when his intentions were only to cleanse the stomach. But when he had a mind to recal the humours, as he termed it, from the inmost recesses of the body, he made use of brisker remedies. Among these was white hellebore; and this indeed he most frequently used to excite vomiting. He gave this root particularly to melancholy and mad people; and from the great use made of it in these cases by Hippocrates and other ancient physicians, the phrase *to have need of hellebore*, became a proverbial expression for being out of one's senses. He gave it also in defluxions, which come, according to him, from the brain, and throw themselves on the nostrils or ears, or fill the mouth with saliva, or that cause stubborn pains in the head, and a weariness or an extraordinary heaviness, or a weakness of the knees, or a swelling all over the body. He gave it to consumptive persons in broth of lentils, to such as were afflicted with the dropsy called *leucophlegmatia*, and in other chronical disorders. But we do not find that he made use of it in acute distempers, except in the cholera morbus, where he says he prescribed it with benefit. Some took this medicine fasting; but most took it after supper, as was commonly practised with regard to vomits taken by way of preservation. The reason why he gave this medicine most commonly after eating was, that by mixing with the aliments, its acrimony might be somewhat abated, and it might operate with less violence on the membranes of the stomach. With the same intention also he sometimes gave a plant called *σφαμιοιδες*, and sometimes mixed it with hellebore. Lastly, in certain cases he gave what he called *soft* or *sweet* hellebore. This term had some relation to the quality of the hellebore, or perhaps to the quantity he gave of it.

When Hippocrates intended only to keep the body open, or evacuate the contents of the intestines, he made use of simples; as for example, the herb mercury, or cabbage; the juice or decoction of which he ordered to be drank. For the same purpose he used whey, and also cows and asses milk; adding a little salt to it, and sometimes letting it boil a little. If he gave asses milk alone, he caused a great quantity of it to be taken, so that it must of necessity loosen the body. In one place he prescribes no less than nine pounds of it to be taken as a laxative, but does not specify the time in which it was to be taken. With the same intention he made use of suppositories and clysters. The former were compounded of honey, the juice of the herb mercury, of nitre, powder of colocynth, and other sharp ingredients, to irritate the anus. These they formed into a ball, or into a long cylindrical mass like a finger. The clysters he made use of for sick people were sometimes the same with those already mentioned as preventatives for people in health. At other times he mixed the decoction of herbs with nitre, honey, and oil, or other ingredients, according as he imagined he could by that means attract, wash, irritate, or soften. The quantity of liquor he ordered was about 36 ounces; from which it was probable he did not intend that it should all be used at one time.

On some occasions Hippocrates proposed to purge the head alone. This practice he employed, after purging the rest of the body, in an apoplexy, inveterate pains of the head, a certain sort of jaundice, a consumption, and the greatest part of chronical distempers. For that purpose he made use of the juices of several plants, as celery; to which he sometimes added aromatic drugs, making the patients snuff up this mixture into their nostrils. He used also powders compounded of myrrh, the flowers of brass, and white hellebore, which he caused them put up into the nose, to make them sneeze, and to draw the phlegm from the brain. For the same purpose also he used what he calls *tetragonon*, that is, "something having four angles;" but what this was, is now altogether unknown, and was so even in the days of Galen. The latter physician, however, conjectures it to be antimony, or certain flakes found in it.

In the distemper called *empyema* (or a collection of matter in the breast), he made use of a very rough medicine. He commanded the patient to draw in his tongue as much as he was able; and when that was done, he endeavoured to put into the hollow of the lungs a liquor that irritated the part, which, raising a violent cough, forced the lungs to discharge the purulent matter contained in them. The materials that he used for this purpose were of different sorts; sometimes he took the root of arum, which he ordered to be boiled with a little salt, in a sufficient quantity of water and oil; dissolving a little honey in it. At other times, when he intended to purge more strongly, he took the flowers of copper and hellebore; after that he shook the patient violently by the shoulders, the better to loosen the pus. This remedy, according to Galen, he received from the Cnidian physicians; and it has never been used by the succeeding ones, probably because the patients could not suffer it.

20 His maxims respecting blood letting.

Blood-letting was another method of evacuation pretty much used by Hippocrates. Another aim he had in this, besides the mere evacuation, was to divert or to recall the course of the blood when he imagined it was going where it ought not. A third end of bleeding was to procure a free motion of the blood and spirits,

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rite, as we may gather from the following paſſage: "When any one becomes ſpeechleſs of a ſudden (ſays he), it is cauſed by the ſhutting of the veins, eſpecially when it happens to perſons otherwiſe in good health, without any outward violence. In this caſe the inward vein of the right-arm muſt be opened, and more or leſs blood taken away, according to the age or conſtitution of the patient. Thoſe that loſe their ſpeech thus have great flushings in their face, their eyes are ſtiff, their arms are diſtended, their teeth gnaſh, they have palpitations of the arteries, cannot open their jaws, the extremities are cold, and the ſpirits are intercepted in the veins. If pain enſues, it is by the acceſſion of the black bile and ſharp humours. For the internal parts being vellicated or irritated by theſe humours, ſuffer very much; and the veins, being alſo irritated and dried, diſtend themſelves extraordinarily, and are inflamed, and draw all that can flow to them; ſo that the blood corrupting, and the ſpirits not being able to paſs through the blood by their ordinary paſſages, the parts grow cold by reaſon of this ſtagnation of the ſpirits. Hence come giddineſs, loſs of ſpeech, and convulſions, if this diſorder reaches to the heart, the liver, or to the great veins. From hence ariſe alſo epilepſies and palſies, if the defluctions fall upon the parts laſt mentioned; and that they dry up, becauſe the ſpirits are denied a paſſage through them. In this caſe, after fomentation, a vein muſt be opened, while the ſpirits and humours are yet ſuſpended and unſettled."

Hippocrates had alſo a fourth intention for bleeding, and this was refreſhment. So in the iliac paſſion, he ordered bleeding in the arm and in the head; to the end, ſays he, that the ſuperior venter, or the breaſt, may ceaſe to be overheated. With regard to this evacuation, his conduct was much the ſame as to purging, in reſpect of time and perſons. We ought, ſays he, to let blood in acute diſeaſes, when they are violent, if the party be luſty and in the flower of his age. We ought alſo to have regard to the time, both in reſpect to the diſeaſe and to the ſeaſon in which we let blood. He alſo informs us, that blood ought to be let in great pains, and particularly in inflammations. Among theſe he reckons ſuch as fall upon the principal viſcera, as the liver, lungs, and ſpleen, as alſo the quinſey and pleuriſy, if the pain of the latter be above the diaphragm. In thoſe caſes he would have the patients blooded till they faint, eſpecially if the pain be very acute; or rather he adviſes that the orifice ſhould not be cloſed till the colour of the blood alters, ſo that from livid it turn red, or from red livid. In a quinſey he bleeded in both arms at once. Difficulty of breathing he alſo reckons among the diſtempers that require bleeding; and he mentions another ſort of inflammation of the lungs, which he calls a ſwelling or tumor of the lungs ariſing from heat; in which caſe he adviſes to bleed in all parts of the body; and directs particularly to the arms, tongue, and noſtrils. To make bleeding the more uſeful in all pains, he directed to open the vein neareſt the part affected; in a pleuriſy he directs to take blood from the arm of the ſide affected; and for the ſame reaſon, in pains of the head, he directs the veins of the noſe and forehead to be opened. When the pain was not urgent, and bleeding was adviſed by way of prevention, he directed the blood to be taken from the parts fartheſt off, with a deſign to divert the blood inſenſibly from the ſeat of pain. The higheſt burning fevers, which ſhow neither ſigns of inflammation nor pain, he does not rank among thoſe diſtempers that require bleeding. On the contrary, he maintains that a fever itſelf is in ſome caſes a reaſon againſt bleeding. If any one, ſays he, has an ulcer in the head, he muſt bleed, *unleſs he has a fever*. He ſays further, thoſe that loſe their ſpeech of a ſudden muſt be blooded, unleſs they have a fever. Perhaps he was afraid of bleeding in fevers, becauſe he ſuppoſed that they were produced by the bile and pituita, which grew hot, and afterwards heated the whole body, which is, ſays he, what we call *fever*, and which, in his opinion, cannot well be evacuated by bleeding. In other places alſo he looks upon the preſence or abundance of bile to be an objection to bleeding; and he orders to forbear veneſection even in a pleuriſy, if there be bile. To this we muſt add, that Hippocrates diſtinguiſhed very particularly between a fever which followed no other diſtemper, but was itſelf the original malady, and a fever which came upon inflammation. In the early ages of phyſic, the firſt were only properly called *fevers*: the others took their names from the parts affected; as *pleuriſy*, *peripneumony*, *hepatitis*, *nephritis*, &c. which names ſignify that the pleura, the lungs, the liver, or the kidneys, are diſeaſed, but do not intimate the fever which accompanies the diſeaſe. In this latter ſort of fever Hippocrates conſtantly ordered bleeding, but not in the former. Hence in his books Of Epidemic Diſtempers, we find but few directions for bleeding in the acute diſtempers, and particularly in the great number of continual and burning fevers there treated of. In the firſt and third book we find but one ſingle inſtance of bleeding, and that in a pleuriſy; in which, too, he ſtaid till the eighth day of the diſtemper. Galen, however, and moſt other commentators on Hippocrates, are of opinion that he generally blooded his patients plentifully in the beginning of acute diſorders, though he takes no notice of it in his writings. But had this been the caſe, he would not perhaps have had the opportunity of ſeeing ſo many fevers terminate by criſes, or natural evacuations, which happen of themſelves on certain days. Hippocrates, in fact, laid ſo much weight upon the aſſiſtance of nature and the method of diet, which was his favourite medicine, that he thought if they took care to diet the patients before mentioned, according to rule, they might leave the reſt to nature. Theſe are his principles, from which he never deviates; ſo that his pieces Of Epidemical Diſeaſes ſeem to have been compoſed only with an intention to leave to poſterity an exact model of management in purſuance of theſe principles.

With regard to the rules laid down by Hippocrates for bleeding, we muſt further take notice, that in all diſeaſes which had their ſeat above the liver, he blooded in the arm, or in ſome of the upper parts of the body; but for thoſe that were ſituated below it he opened the veins of the foot, ankle, or ham. If the belly was too laxative, and bleeding was at the ſame time thought neceſſary, he ordered the looſeneſs to be ſtopped before bleeding.

Almoſt all theſe inſtances, however, regard ſcarce any thing but acute diſtempers; but we find ſeveral con-

Hippocrates.

concerning chronical diſeaſes. "A young man complained of great pain in his belly, with a rumbling while he was faſting, which ceaſed after eating: this pain and rumbling continuing, his meat did him no good; but, on the contrary, he daily waſted and grew lean. Several medicines, as well purges as vomits, were given him in vain. At length it was reſolved to bleed him by intervals, firſt in one arm and then in the other, till he had ſcarce any blood left, and by this method he was perfectly cured."

Hippocrates let blood alſo in a dropſy, even in a tympany; and in both caſes he preſcribes bleeding in the arm. In a diſeaſe occaſioned by an overgrown ſpleen, he propoſes bleeding ſeveral times repeated at a vein of the arm which he calls the *ſplenetic*; and in a kind of jaundice, he propoſes bleeding under the tongue. On ſome occaſions he took away great quantities of blood, as appears from what we have already obſerved. Sometimes he continued the blooding till the patient fainted: at other times he would blood in both arms at once; at others, he did it in ſeveral places of the body, and at ſeveral times. The veins he opened were thoſe of the arm, the hands, the ankles on both ſides, the hams, the forehead, behind the head, the tongue, the noſe, behind the ears, under the breaſts, and thoſe of the arms; beſides which, he burnt others, and opened ſeveral arteries. He likewiſe uſed cupping-veſſels, with intent to recal or withdraw the humours which fell upon any part. Sometimes he contented himſelf with the bare attraction made by the cupping-veſſels, but ſometimes alſo he made ſcarifications.

21 His maxims reſpecting diuretics and ſudorifics.

When bleeding and purging, which were the principal and moſt general means uſed by Hippocrates for taking off a plethora, proved inſufficient for that purpoſe, he had recourſe to diuretics and ſudorifics. The former were of different ſorts, according to the conſtitution of the perſons: ſometimes baths, and ſometimes ſweet wine, were employed to provoke urine; ſometimes the nouriſhment which we take contributes to it: and amongſt thoſe herbs which are commonly eaten, Hippocrates recommends garlic, leeks, onions, cucumbers, melons, gourds, fennel and all other things which have a biting taſte and a ſtrong ſmell. With theſe he numbers honey, mixed with water or vinegar, and all ſalt meats. But, on ſome occaſions, he took four cantharides, and pulling off their wings and feet, gave them in wine and honey. Theſe remedies were given in a great number of chronical diſtempers after purging, when he thought the blood was overcharged with a ſort of moiſture which he calls *ichor*; or in ſuppreſſions of urine, and when it was made in leſs quantity than it ought. There were alſo ſome caſes in which he would force ſweat as well as urine; but he neither mentions the diſeaſes in which ſudorifics are proper, nor lets us know what medicines are to be uſed for this purpoſe, except in one ſingle paſſage, where he mentions ſweating, by pouring upon the head a great quantity of water till the feet ſweat; that is, till the ſweat diffuſes itſelf over the whole body, running from head to foot. After this he would have them eat boiled meat, and drink pure wine, and being well covered with clothes, lay themſelves down to reſt. The diſeaſe for which he propoſes the abovementioned remedy is a fever; which is not, according to him, produced by bile or pituita, but by mere laſſitude, or ſome other ſimilar cauſe; from whence we may conclude that he did not approve of ſweating in any other kind of fever.

Other remedies which Hippocrates tells us he made uſe of were theſe that purged neither bile nor phlegm, but act by cooling, drying, heating, moiſting, or by cloſing and thickning, reſolving and diſſipating. Theſe medicines, however, he does not particularly mention; and it is probable they were only ſome particular kinds of food. To theſe he joined *hypnotics*, or ſuch things as produce ſleep; but theſe laſt were uſed very ſeldom, and, it is moſt probable, were only different preparations of poppies.

22 The uſe he made of ſpecifics.

Laſtly, beſides the medicines already mentioned, which acted in a ſenſible manner, Hippocrates made uſe of others called *ſpecifics*; whoſe action he did not underſtand, and for the uſe of which he could give no reaſon beſides his own experience, or that of other phyſicians. Theſe he had learned from his predeceſſors the deſcendants of Æſculapius, who, being *empirics*, did not trouble themſelves about inquiring into the operation of their remedies, provided their patients were cured.

23 His external applications.

Of the external remedies preſcribed by Hippocrates, fomentations were the chief. Theſe were of two kinds. The one was a ſort of bath, in which the patient ſat in a veſſel full of a decoction of ſimples appropriated to his malady; ſo that the part effected was ſoaked in the decoction. This was chiefly uſed in diſtempers of the womb, of the arms, the bladder, the reins, and generally all the parts below the diaphragm. The ſecond way of fomenting was, to take warm water and put it into a ſkin or a bladder, or even into a copper or earthen veſſel, and to apply it to the part affected; as, for example, in a pleuriſy. They uſed likewiſe a large ſponge, which they dipped in the water, or other hot liquor, and ſqueezed out part of the liquor before they applied it. The ſame uſe they made of barley, vetches, or bran, which were boiled in ſome proper liquor, and applied in a linen bag. Theſe are called *moiſt* fomentations. The dry ones were made of ſalt or millet, heated conſiderably, and applied to the part. Another kind of fomentation was the vapour of ſome hot liquor; an inſtance of which we find in his firſt book of Womens Diſtempers. He caſt, at ſeveral times, bits of red-hot iron into urine, and, covering up the patient cloſe, cauſed her to receive the ſteam below. His deſign in theſe kinds of fomentations was to warm the part, to reſolve or diſſipate, and draw out the peccant matter, to mollify and aſſuage pain, to open the paſſages, or even to ſhut them, according as the fomentations were emollient or aſtringent.

24 Fomentations.

25 Fumigations.

Fumigations were likewiſe very often uſed by Hippocrates. In the quinſey, he burned hyſſop with ſulphur and pitch, and cauſed the ſmoke to be drawn into the throat by a funnel; and by this means he brought away abundance of phlegm through the mouth and through the noſe. For this purpoſe he took nitre, marjoram, and creſs-ſeeds, which he boiled in water, vinegar, and oil, and, while it was on the fire, cauſed the patient to draw in the ſteam by a pipe. In his works we find a great number of fumigants for the diſtempers of women, to promote the menſtrual

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flux, to check it, to help conception, and to ease pains in the matrix, or the suffocation of it. On these occasions he used such aromatics as were then known, viz. cinnamon, cassia, myrrh, and several odoriferous plants; likewise some minerals, such as nitre, sulphur, and pitch, and caused them to receive the vapours through a funnel into the uterus.

26 Gargles.

Gargles, a kind of fomentations for the mouth, were also known to Hippocrates. In the quinsey he used a gargle made of marjoram, savory, celery, mint and nitre, boiled with water and a little vinegar. When this was strained, they added honey to it, and washed their mouths frequently with it.

27 Oils and ointments.

Oils and ointments were likewise much used by Hippocrates, with a view to mollify and abate pain, to ripen boils, resolve tumors, refresh after weariness, make the body supple, &c. For this purpose, sometimes pure oil of olives was used; sometimes certain simples were infused in it, as the leaves of myrtle and roses; and the latter kind of oil was in much request among the ancients. There were other sorts of oils sometimes in use, however, which were much more compounded. Hippocrates speaks of one called *susinum*, which were made of the flowers of the iris, of some aromatics, and of an ointment of narcissus made with the flowers of narcissus and aromatics infused in oil. But the most compounded of all his ointments was that called *netopum*, which he made particularly for women; and consisted, according to Hesychius, of a great number of ingredients. Another ointment, to which he gave the name of *ceratum*, was composed of oil and wax. An ointment which he recommends for the softening of a tumor, and the cleansing of a wound, was made by the following receipt; "Take the quantity of a nut of the marrow or fat of a sheep, of mastic or turpentine the quantity of a bean, and as much wax; melt these over a fire, with oil of roses, for a ceratum." Sometimes he added pitch and wax, and with a sufficient quantity of oil, made a composition somewhat more consistent than the former, which he called *cerapissus*.

28 Cataplasms

Cataplasms were a sort of remedies less consistent than the two former. They were made of powders or herbs steeped or boiled in water or some other liquor, to which sometimes they added oil. They were used with a view to soften or resolve tumors, ripen abscesses, &c. though they had also cooling cataplasms made of the leaves of beets or oak, fig or olive-trees, boiled in water.

29 Collyria.

Lastly, to complete the catalogue of the external remedies used by Hippocrates, we shall mention a sort of medicine called *collyrium*. It was compounded of powders, to which was added a small quantity of some ointment, or juice of a plant, to make a solid or dry mass; the form of which was long and round, which was kept for use. Another composition of much the same nature was a sort of lozenge of the bigness of a small piece of money, which was burnt upon coals for a perfume, and powdered for particular uses. In his works we find likewise descriptions of powders for several uses, to take off fungous flesh, and to blow into the eyes in ophthalmies, &c.

These were almost all the medicines used by Hippocrates for external purposes. The compound medicines given inwardly were either liquid, solid, or lambative. The liquid ones were prepared either by decoction or infusion in a proper liquor, which, when strained, was kept for use; or by macerating certain powders in such liquors, and so taking them together, or by mixing different kinds of liquors together. The solid medicines consisted of juices inspissated; of gums, resins, or powders, made up with them or with honey, or something proper to give the necessary consistence to the medicine. These were made up in a form and quantity fit to be swallowed with ease. The lambative was of a consistence between solid and fluid; and the patients were obliged to keep it for some time to dissolve in the mouth, that they might swallow it leisurely. This remedy was used to take off the acrimony of these humours which sometimes fall upon this part, and provoke coughing and other inconveniences. The basis of this last composition was honey. It is worth our observation, that the compound medicines of Hippocrates were but very few, and composed only of four or five ingredients at most, and that he not only understood pharmacy, or the art of compounding medicines, but prepared such as he used himself, or caused his servants prepare them in his house by his directions.

We have thus given some account of the state of medicine as practised and taught by Hippocrates, who, as we have already observed, has for many ages been justly considered as the father of physic. For when we attend to the state in which he found medicine, and the condition in which he left it, we can hardly bestow sufficient admiration on the judgment and accuracy of his observations. After a life spent in unwearied industry, he is said to have died at Larissa, a city in Thessaly, in the 102d year of his age, 361 years before the birth of Christ.

After the days of Hippocrates, medicine in ancient Greece gradually derived improvement from the labours of other physicians of eminence. And we may particularly mention three to whom its future progress seems to have been not a little indebted, viz. Praxagoras, Erasistratus, and Herophilus.

30 Praxagoras

The first physician of eminence who differed considerably in his practice from Hippocrates was Praxagoras. Cœlius Aurelianus acquaints us, that he made great use of vomits in his practice, insomuch as to exhibit them in the iliac passion till the excrements were discharged by the mouth. In this distemper he also advised, when all other means failed, to open the belly, cut the intestine, take out the indurated fæces, and then to sew up all again; but this practice has not probably been followed by any subsequent physician.

31 Erasistratus

Erasistratus was a physician of great eminence, and flourished in the time of Seleucus, one of the successors of Alexander the Great. According to Galen, he entirely banished venesection from medicine; though some affirm that he did not totally discard it, but only used it less frequently than other physicians. His reasons for disapproving of venesection are as follow: It is difficult to succeed in venesection, because we cannot always see the vein we intend to open, and because we are not sure but we may open an artery instead of a vein. We cannot ascertain the true quantity to be taken. If we take too little, the intention is by no means answered; if we take too much, we run a risk of destroying the patient. The evacuation of the venous blood also is

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Erasistratus succeeded by that of the spirits, which on that occasion pass from the arteries into the veins. It must likewise be observed, that as the inflammation is formed in the arteries by the blood coagulated in their orifices, venesection must of course be useless and of no effect.

As Erasistratus did not approve of venesection, so neither did he of purgatives, excepting very rarely, but exhibited clysters and vomits; as did also his master Chrysippus. He was of opinion, however, that the clysters should be mild; and condemned the large quantity and acrid quality of those used by the ancients. The reason why purgatives were not much used by him was, that he imagined purging and venesection could answer no other purpose than diminishing the fulness of the vessels; and for this purpose he asserted that there were more effectual means than either phlebotomy or purging. He asserted that the humours discharged by cathartics were not the same in the body that they appeared after the discharge; but that the medicines changed their nature, and produced a kind of corruption in them. This opinion has since been embraced by a great number of physicians. He did not believe that purgatives acted by attraction; but substituted in the place of this principle what Mr Le Clerc imagines to be the same with Aristotle's *fuga vacui*. The principal remedy substituted by him in place of purging and venesection was abstinence. When this, in conjunction with clysters and vomits, was not sufficient to eradicate the disease, he then had recourse to exercise. All this was done with a view to diminish the plenitude, which, according to him, was the most frequent cause of all diseases. Galen also informs us, that Erasistratus had so great an opinion of the virtues of succory in diseases of the viscera and lower belly, and especially in those of the liver, that he took particular pains to describe the method of boiling it, which was, to boil it in water till it was tender; then to put it into boiling water a second time, in order to destroy its bitterness; afterwards to take it out of the water, and preserve it in a vessel with oil; and lastly, when it is to be used, add a little weak vinegar to it. Nay, so minute and circumstantial was Erasistratus with regard to the preparation of his favourite succory, that he gave orders to tie several of the plants together, because that was the more commodious method of boiling them. The rest of Erasistratus's medicines consisted almost entirely of regimen; to which he added some topical remedies, such as cataplasms, fomentations, and unctions. In short, as he could neither endure compounded medicines, nor superstitious and fine-spun reasonings, he reduced medicine to a very simple and compendious art.

With regard to surgery, Erasistratus appears to have been very bold; and as an anatomist he is said to have been exceedingly cruel, insomuch that he is represented by some as having dissected criminals while yet alive *. In a scirrhous liver, or in tumors of that organ, Cœlius Aurelianus observes, that Erasistratus made an incision through the skin and integuments, and having opened the abdomen he applied medicines immediately to the part affected. But tho' he was thus bold in performing operations on the liver, yet he did not approve of the paracentesis or tapping in the dropsy; because (said he) the waters being evacuated, the liver, which is inflamed and become hard like a stone, is more pressed by the adjacent parts which the waters kept at a distance from it, so that by this means the patient dies. He declared also against drawing teeth which were not loose; and used to tell those who talked with him on this operation, That in the temple of Apollo there was to be seen an instrument of lead for drawing teeth; in order to insinuate that we must not attempt the extirpation of any but such as are loose, and call for no greater force for their extirpation than what may be supposed in an instrument of lead.

* See Anatomy, *Hist.*

Erasistrants

32 Herophilus.

Herophilus, the disciple of Praxagoras, and cotemporary of Erasistratus, followed a less simple practice: he made so great use of medicines both simple and compound, that neither he nor his disciples would undertake the cure of any disorder without them. He seems also to have been the first who treated accurately of the doctrine of pulses, of which Hippocrates had but a superficial knowledge. Galen, however, affirms, that on this subject he involved himself in difficulties and advanced absurdities; which indeed we are not greatly to wonder at, considering the time in which he lived. He took notice of a disease at that time pretty rare, and to which he ascribes certain sudden deaths. He calls it a *palsy of the heart*; and perhaps it may be the same disease with what is now termed the *angina pectoris*.

According to Celsus, it was about this time that medicine was first divided into three branches, viz. the dietetic, the pharmaceutical, and the chirurgical medicine. The first of these employed a proper regimen in the cure of diseases; the second, medicines; and the third, the operation of the hands: and the same author informs us, that these three branches became now the business of as many distinct classes of men; so that from this time we may date the origin of the three professions of physicians, apothecaries, and surgeons.—Before this division, those called *physicians* discharged all the several offices belonging to the three professions; and there were only two kinds of them, viz. one called αρχιτεκτονικοι, who only gave their advice to the patients, and directions to those of an inferior class, who were called δημιουργοι, and worked with their hands either in the performing operations, or in the composition and application of remedies.

33 The Empirics.

The first grand revolution which happened in the medicinal art after the days of Herophilus and Erasistratus was occasioned by the founding of the empiric sect by Serapion of Alexandria about 284 years before Christ. The division into dogmatists and empirics had indeed subsisted before; but about this time the latter party began to grow strong, and to have champions publicly asserting its cause. Galen informs us, that Serapion used Hippocrates very ill in his writings, in which he discovered an excess of pride, self-sufficiency, and contempt for all the physicians that went before him. We have some sketches of his practice in Cœlius Aurelianus, from which we may infer that he retained the medicines of Hippocrates and the other physicians who went before him, tho' he rejected their reasoning. We know not what arguments he advanced for the support of his sentiments, since his works are lost, as well as those of the other empirics; and we should know nothing at all of any

34 Serapion.

Serapion. of them, if their adversaries had not quoted them in order to confute them.

The empirics admitted only one general method of obtaining skill in the medical art, which was by experience, called by the Greeks εμπειρια. From this word they took their name, and refused to be called after the founder or any champion of their sect. They defined experience a knowledge derived from the evidence of sense. It was either fortuitous, or acquired by design. For acquiring practical skill they recommended what they called τηρησις, or one's own observation, and the reading of histories or cases faithfully related by others. Hence they thought that we are enabled to know a disease by its resemblance to others; and, when new diseases occurred, to conclude what was proper to be done from the symptoms they had in common with others that were before known. They asserted, that observation ought principally to be employed in two different ways; first in discovering what things are salutary, and what are of an indifferent nature; and, secondly, what particular disease is produced by a certain concurrence of symptoms; for they did not call every symptom a disease, but only such a combination of them as from long experience they found to accompany each other, and produced such disorders as began and terminated in the same manner.

On the other hand, the dogmatist affirmed, that there was a necessity for knowing the latent as well as the evident causes of diseases, and that the physician ought to understand the natural actions and functions of the human body, which necessarily presupposes a knowledge of the internal parts. By secret or latent causes they meant such as related to the elements or principles of which our bodies are composed, and which are the origin of a good or bad state of health. They asserted that it was impossible to know how to cure a disease without knowing the cause whence it proceeded; because undoubtedly it behoved them to vary prodigiously in themselves according to the different causes by which they were produced.

35 Asclepiades. The next remarkable person in the history of physic is Asclepiades, who flourished in the century immediately preceding the birth of Christ. He introduced the philosophy of Democritus and Epicurus into medicine, and ridiculed the doctrines of Hippocrates. He asserted, that matter considered in itself was of an unchangeable nature; and that all perceptible bodies were composed of a number of smaller ones, between which there were interspersed an infinity of small spaces totally void of all matter. He thought that the soul itself was composed of these small bodies. He laughed at the principle called *Nature* by Hippocrates, and also at the imaginary faculties said by him to be subservient to her; and still more at what he called *Attraction*. This last principle Asclepiades denied in every instance, even in that of the loadstone and steel, imagining that this phenomenon proceeded from a concourse of corpuscles, and a particular disposition or modification of their pores. He also maintained, that nothing happened or was produced without some cause; and that what was called *nature* was in reality no more than *matter* and *motion*. From this last principle he inferred that Hippocrates knew not what he said when he spoke of Nature as an intelligent being, and ascribed qualities of different kinds to her. For the same reason he ridiculed the doctrine of Hippocrates with regard to crises; and asserted that the termination of diseases might be as well accounted for from mere matter and motion. He maintained, that we were deceived if we imagined that nature always did good; since it was evident that she often did a great deal of harm. As for the days particularly fixed upon by Hippocrates for crises, or those on which we usually observe a change either for the better or the worse, Asclepiades denied that such alterations happened on those days rather than on others. Nay, he asserted that the crisis did not happen at any time of its own accord, or by the particular determination of nature for the cure of the disorder, but that it depended rather on the address and dexterity of the physician; that we ought never to wait till a distemper terminates of its own accord, but that the physician by his care and medicines must hasten on and advance the cure.—According to him, Hippocrates and other ancient physicians attended their patients rather with a view to observe in what manner they died than in order to cure them; and this under pretence that Nature ought to do all herself, without any assistance. Asclepiades.

According to Asclepiades; the particular assemblage of the various corpuscles abovementioned, and represented as of different figures, is the reason why there are several pores or interstices within the common mass, formed by these corpuscles; and why these pores are of a different size. This being taken for granted, as these pores are in all the bodies we observe, it must of course follow that the human body has some peculiar to itself, which, as well as those of all other bodies, contain other minute bodies, which pass and repass by those pores that communicate with each other; and as these pores or interstices are larger or smaller, so the corpuscles which pass through them differ proportionably as to largeness and to minuteness. The blood consists of the largest of these corpuscles, and the spirits, or the heat, of the smallest.

From these principles he infers, that as long as the corpuscles are freely received by the pores, the body remains in its natural state; and on the contrary, it begins to recede from that state, when the corpuscles find any obstacle to their passage. Health therefore depends on the just proportion between the pores and the corpuscles they are destined to receive and transmit; as diseases, on the contrary, proceed from a disporportion between these pores and the corpuscles. The most usual obstacle on this occasion proceeds from the corpuscles embracing each other, and being retained in some of their ordinary passages, whether these corpuscles arrive in too large a number, are of irregular figures, move too fast or too slow, &c.

Among the disorders produced by the corpuscles stopping of their own accord, Asclepiades reckoned phrensies, lethargies, pleurisies and burning fevers. Pains, in particular, are classed among the accidents which derive their origin from a stagnation of the largest of all the corpuscles of which the blood consists. Among the disorders produced by the bad state and disposition of the pores, he placed deliquiums, languors, extenuations, leanness, and dropsies. These last disorders he thought proceeded from the pores being too much relaxed and opened; the dropsy in por-

Asclepiades

particular, he thinks, proceeds for the flesh being perforated with various small holes, which convert the nourishment received into them into water. Hunger, and especially that species of it called *fames canina*, proceeds from an opening of the large pores of the stomach and belly; and thirst from an opening of their small ones. Upon the same principles he accounted for intermittent fevers. Quotidian fevers are caused by a retention of the largest corpuscles, those of the tertian kind by a retention of corpuscules somewhat smaller, and quartan fevers are produced by a retention of the smallest corpuscles of all.

The practice of Asclepiades was suited to remove these imaginary causes of disorders. He composed a book concerning common remedies, which he principally reduced to three, *viz.* gestation, friction, and the use of wine. By various exercises he proposed to render the pores more open, and to make the juices and small bodies, which cause diseases by their retention, pass more freely; and while the former physicians had not recourse to gestation till towards the end of long continued disorders, and when the patients, tho' entirely free from fever, were yet too weak to take sufficient exercise by walking, Asclepiades used gestation from the very beginning of the most burning fevers. He laid it down as a maxim, that one fever was to be cured by another; that the strength of the patient was to be exhausted by making him watch and endure thirst to such a degree, that, for the two first days of the disorder, he would not allow them to cool their mouths with a drop of water. Celsus also observes, that though Asclepiades treated his patients like a butcher during the first days of the disorder, he indulged them so far afterwards as even to give directions for making their beds in the softest manner. On several occasions Asclepiades used frictions to open the pores. The dropsy was one of the distempers in which this remedy was used; but the most singular attempt was, by this means, to lull phrenetic patients asleep. But though he enjoined exercise so much to the sick, he denied it to those in health; a piece of conduct not a little surprising and extraordinary. He allowed wine freely to patients in fevers, provided the violence of the distemper was somewhat abated. Nor did he forbid it to those who were afflicted with a phrenzy; nay, he ordered them to drink it till they were intoxicated, pretending by that means to make them sleep; because, he said, wine had a narcotic quality and procured sleep, which he thought absolutely necessary for those who labour under that disorder. To lethargic patients he used it on purpose to excite them, and rouse their senses; he also made them smell strong-scented substances, such as vinegar, castor, and rue, in order to make them sneeze; and applied to their heads cataplasms of mustard made up with vinegar.

Besides these remedies, Asclepiades enjoined his patients abstinence to an extreme degree. For the first three days, according to Celsus, he allowed them no aliment whatever; but on the fourth began to give them victuals. According to Cælius Aurelianus, however, he began to nourish his patients as soon as the accession of the disease was diminished, not waiting till an entire remission; giving to some aliments on the first, to others on the second, to others on the third, and so on to the seventh day. It seems almost incredible to us, that people should be able to fast till this last mentioned term; but Celsus assures us, that abstinence till the seventh day was enjoined by the predecessors of Asclepiades, and by Heraclides Tarentinus.

The next great revolution which happened in the medicinal art, was brought about by Themison, the disciple of Asclepiades, who lived not long before the time of Celsus, during the end of the reign of Augustus, or beginning of that of Tiberius. The sect founded by him was called *methodic*, because he endeavoured to find a method of rendering medicine more easy than formerly. 36 Methodic sect.

He maintained, that a knowledge of the causes of diseases was not necessary, provided we have a due regard to what diseases have in common and analogous to one another. In consequence of this principle, he divided all diseases into two, or at most three, kinds. The first included diseases arising from stricture; the second, those arising from relaxation; and the third, those of a mixed nature, or such as partook, both of stricture and relaxation. 37 Themison.

Themison also asserted, that diseases are sometimes acute, and sometimes chronical; that for a certain time they increase; that at a certain time they are at their height: and that at last they were observed to diminish. Acute diseases, therefore according to him, must be treated in one way, and chronical ones in another; one method must be followed with such as are in their augmentation, another with such as are at their height, and a third with such as are in their declension. He asserted, that the whole of medicine consisted in the observation of that small number of rules which are founded upon things altogether evident. He said, that all disorders, whatever their nature was, if included under any of the kinds abovementioned, ought to be treated precisely in the same way, in whatever country and with whatever symptoms they happen to arise. Upon these principles, he defined medicine to be a method of conducting to the knowledge of what diseases have in common with each other, and which at the same time is evident.

Themison was old when he laid the foundation of the Methodic sect; and it was only brought to perfection by Thessalus, who lived under the emperor Nero. Galen and Pliny accuse this physician of intolerable insolence and vanity, and report that he gave himself the air of despising all other physicians; and so intolerable was his vanity, that he assumed the title of *the conqueror of physicians*, which he caused to be put upon his tomb in the Appian way. Never was mountebank (says Pliny) attended by a greater number of spectators than Thessalus had generally about him; and this circumstance is the less to be wondered at, if we consider that he promised to teach the whole art of medicine in less than six months. In reality, the art might be learned much sooner if it comprehended no more than what the methodists thought necessary; for they cut off the examination of the causes of diseases followed by the dogmatics; and substituted in the room of the laborious observations of the empirics, indications drawn from the analogy of diseases, and the mutual resemblance they bear to each other. The most skilful of all the methodic sect, and he who put the last hand to it, was Soranus. He lived under the emperors Trajan and Adrian, and was a native of Ephesus. 38 Thessalus. 39 Soranus.

One of the most celebrated medical writers of antiquity

Celsus.

tiquity was Celsus, whom we have already had occasion to mention. Most writers agree that he lived in the time of Tiberius, but his country is uncertain. It is even disputed whether or not he was a professed physician. Certain it is, however, that his books on medicine are the most valuable of all the ancients next to those of Hippocrates. From the latter, indeed, he has taken so much, as to acquire the name of the *Latin Hippocrates;* but he has not attached himself to him so closely as to reject the assistance of other authors. In many particulars he has preferred Asclepiades. With him he laughs at the critical days of Hippocrates, and ascribes the invention of them to a foolish and superstitious attachment to the Pythagorean doctrine of numbers. He also rejected the doctrine of Hippocrates with regard to venesection, of which he made a much more general use; but did not take away so much at a time, thinking it much better to repeat the operation than weaken the patient by too great an evacuation at one time. He used cupping also much more frequently, and differed from him with regard to purgatives. In the beginning of disorders, he said, the patients ought to endure hunger and thirst; but afterwards they were to be nourished with good aliments; of which, however, they were not to take too much, nor fill themselves all of a sudden, after having fasted. He does not specify how long the patient ought to practise abstinence; but affirms, that in this particular it is necessary to have a regard to the disease, the patient, the season, the climate, and other circumstances of a like nature. The signs drawn from the pulse he looked upon to be very precarious and uncertain. "Some (says he) lay great stress upon the beating of the veins or the arteries; which is a deceitful circumstance, since that beating is slow or quick, and varies very much, according to the age, sex, and constitution of the patient. It even sometimes happens that the pulse is weak and languid when the stomach is disordered, or in the beginning of a fever, though in other respects the body be in a good state; so that we might, in this latter case, be induced to believe, that a man is very weak, when he is just entering into a violent paroxysm, has strength enough left, and may be easily recovered from it. On the contrary, the pulse is often high, and in a violent commotion, when one has been exposed to the sun, or comes out of a bath, or from using exercise; or when one is under the influence of anger, fear, or any other passion. Besides the pulse is easily changed by the arrival of the physician, in consequence of the patient's anxiety to know what judgment he will pass upon his case. To prevent this, the physician must not feel the patient's pulse on his first arrival; he must first sit down by him, assume a chearful air, inform himself of his condition; and if he is under any dread, endeavour to remove it by encouraging discourse; after which he may examine the beating of the artery. This nevertheless does not hinder us from concluding, that if the sight of the physician alone can produce so remarkable a change in the pulse, a thousand other causes may produce the same effect." But although Celsus thought for himself, and in not a few particulars differed from his predecessors, yet in his writings, which are not only still preserved, but have gone through almost innumerable editions, we have a compendious view of the practice of almost all his predecessors; and he treats of the healing art in all its branches, whether performed *manu, victu, vel medicamentis.* His writings, therefore, will naturally be had recourse to by every one who wishes either to become acquainted with the practice of the ancients prior to the fall of the Roman empire, or to read medical Latin in its greatest purity.

Celsus.

41 Galen.

About the 131st year after Christ, in the reign of the emperor Adrian, lived the celebrated Galen, a native of Pergamus, whose name makes such a conspicuous figure in the history of physic. At this time the dogmatic, empiric, methodic, and other sects, had each their abettors. The methodics were held in great esteem, and looked upon to be superior to the dogmatics, who were strangely divided among themselves, some of them following Hippocrates, others Erasistratus, and others Asclepiades. The empirics made the least considerable figure of any. Galen undertook the reformation of medicine, and restored dogmatism. He seems to have been of that sect which was called *eclectic*, from their choosing out of different authors what they esteemed good in them, without being particularly attached to any one more than the rest. This declaration he indeed sets out with; but, notwithstanding this, he follows Hippocrates much more than any of the rest, or rather follows nobody else but him. Though before his time several physicians had commented on the works of Hippocrates, yet Galen pretends that none of them had understood his meaning. His first attempt therefore was to explain the works of Hippocrates; with which view he wrote a great deal, and after this set about composing a system of his own. In one of his books entitled, "Of the establishment of medicine," he defines the art to be one which teaches to preserve health and cure diseases. In another book, however, he proposes the following definition: "Medicine (says he) is a science which teaches what is sound, and what is not so; and what is of an indifferent nature, or holds a mediun between what is sound and what is the reverse." He affirmed, that there are three things which constitute the object of medicine, and which the physician ought to consider as sound, as not sound, or of a neutral and different nature. These are the body itself, the signs, and the causes. He esteems the human body sound, when it is in a good state or habit with regard to the simple parts of which it is composed, and when besides there is a just proportion between the organs formed of these simple parts. On the contrary, the body is reckoned to be unsound, when it recedes from this state, and the just proportion abovementioned. It is in a state of neutrality or indifference, when it is in a medium between soundness and its opposite state. The salutary signs are such as indicate present health, and prognosticate that the man may remain in that state for some time to come. The insalubrious signs, on the contrary, indicate a present disorder, or lay a foundation for suspecting the approach of one. The neutral signs, or such as are of an indifferent nature, denote neither health nor indisposition, either for the present, or for the time to come. In like manner he speaks of causes salutary, unsalutary, and indifferent.

These three dispositions of the human body, that is, soundness, its reverse, and a neutral state, comprehend all the difference between health and disorder or indispo-

Galen.

disposition: and each of these three states or dispotions has a certain extent peculiar to itself. A sound habit of body, according to the definition of it already given, is very rare, and perhaps never to be met with; but this does not hinder us to suppose such a model for regulating our judgment with respect to different constitutions. On this principle Galen establishes eight other principal constitutions, all of which differ more or less from the perfect model abovementioned. The four first are such as have one of the four qualities of hot, cold, moist, or dry, prevailing in too great a degree; and accordingly receive their denomination from that quality which prevails over the rest. The four other species of constitutions receive their denomination from a combination of the abovementioned; so that, according to his definition, there may be a hot and dry, a hot and moist, a cold and moist, and a cold and dry, constitution. Besides these differences, there are certain others which result from occult and latent causes, and which, by Galen, are said to arise from an *idiosyncrasy* of constitution. It is owing to this idiosyncrasy that some have an aversion to one kind of aliment and some to another; that some cannot endure particular smells, &c. But though these eight last-mentioned constitutions fall short of the perfection of the first, it does not thence follow, that those to whom they belong are to be classed among the valetudinary and diseased. A disease only begins when the deviation becomes so great as to hinder the action of the parts.

Galen describes at great length the signs of a good or bad constitution, as well as those of what he calls a *neutral habit*. These signs are drawn from the original qualities of cold, hot, moist, and dry, and from their just proportion or disproportion with respect to the bulk, figure, and situation, of the organical parts. With Hippocrates he establishes three principles of an animal body; the parts, the humours, and the spirits. By the parts he properly meant no more than the solid parts; and these he divided into similar and organical. Like Hippocrates, he also acknowledged four humours; the blood, the phlegm, the yellow bile and black bile. He established three different kinds of spirits; the vital, the animal, and the natural. The first of these are, according to him, nothing else but a subtle vapour arising from the blood, which draws its origin from the liver, the organ or instrument of sanguification. After these spirits are conveyed to the heart, they, in conjunction with the air we draw into the lungs, become the matter of the second species, that is, of the vital spirits, which are again changed into those of the animal kind in the brain. He supposed that these three species of spirits served as instruments of three kinds of faculties, which reside in the respective parts where these faculties are formed. The natural faculty is the first of these, which he placed in the liver, and imagined to preside over the nutrition, growth, and generation, of the animal. The vital faculty he lodged in the heart, and supposed that by means of the arteries it communicated warmth and life to all the body. The animal faculty, the noblest of all the three, and with which the reasoning or governing faculty was joined, according to him, has its seat in the brain; and, by means of the nerves, distributes a power of motion and sensation to all the parts, and presides over all the other faculties. The original source or principle of motion in all these faculties, Galen, as well as Hippocrates, defines to be *Nature*.

Upon these principles Galen defined a disease to be "such a preternatural disposition or affection of the parts of the body, as primarily, and of itself, hinders their natural and proper action." He established three principal kinds of diseases: the first relates to the similar parts; the second, to the organical; and the third is common to both these parts. The first kind of diseases consists in the intemperature of the similar parts; and this is divided into an intemperature *without matter*, and an intemperature *with matter*. The first discovers itself when a part has more or less heat or cold than it ought to have without that change of quality in the part being supported and maintained by any matter. Thus, for instance, a person's head may be overheated and indisposed by being exposed to the heat of the sun, without that heat being maintained by the continuance or congestion of any hot humour in the part. The second sort of intemperature is when any part is not only rendered hot or cold, but also filled with a hot or cold humour, which are the causes of the heat or cold felt in the part. Galen also acknowledged a simple intemperature: that is, when one of the original qualities, such as heat or cold, exceeds alone and separately; and a compound intemperature, when two qualities are joined together, such as heat and dryness, or coldness and humidity. He also established an equal and unequal temperature. The former is that which is equally in all the body, or in any particular part of it, and which creates no pain, because it is become habitual, such as dryness in the hectic constitution. The latter is distinguished from the former, in that it does not equally subsist in the whole of the body, or in the whole of a part. Of this kind of intemperature we have examples in certain fevers, where heat and cold, equally, and almost at the same time, attack the same part; or in other fevers, which render the surface of the body cold as ice, while the internal parts burn with heat; or lastly, in cases where the stomach is cold and the liver hot.

The second kind of disorders, relating to the organical parts, results from irregularities of these parts, with respect to the number, bulk, figure situation, &c.; as when one has six fingers, or only four; when one has any part larger or smaller than it ought to be, &c. The third kind, which is common both to the similar and the organical parts, is a solution of continuity, which happens when any similar or compound part is cut, bruised, or corroded.

Like Hippocrates, Galen distinguished diseases into acute and chronical; and, with respect to their nature and genius, into benign and malignant; also into epidemic, endemic, and sporadic.

After having distinguished the kinds of diseases, Galen comes to explain the causes; which he divides into external and internal. The external causes of diseases, according to him, are six things, which contribute to the preservation of health when they are well disposed and properly used, but produce a contrary effect when they are imprudently used or ill disposed. These six things are, the air, aliments and drink, motion and rest, sleeping and watching, retention and excretion, and lastly the passions. All these are called the *procatarctic* or *beginning* causes, because they put in

Galen.

in motion the internal causes; which are of two kinds, the *antecedent* and the *conjunct*. The former is discovered only by reasoning; and consists for the most part in a peccancy of the humours, either by plenitude or cacochymy, *i. e.* a bad state of them. When the humours are in too large a quantity, the case is called a *plethora*; but we must observe, that this word equally denotes too large a quantity of all the humours together, or a redundance of one particular humour which prevails over the rest. According to these principles, there may be a sanguine, a bilious, a pituitous, or a melancholy plenitude: but there is this difference between the sanguine and the three other plenitudes, that the blood, which is the matter of the former, may far surpass the rest: whereas, if any of the three last mentioned ones do so, the case is no longer called *plenitude*, but *cacochymy*; because the humours, abounding more than they ought, corrupt the blood The causes he also divides into such as are manifest and evident, and such as are latent and obscure. The first are such as spontaneously come under the cognizance of our senses when they act or produce their effects: the second are not of themselves perceptible, but may be discovered by reasoning: the third sort, *i. e.* such as he calls *occult* or *concealed*, cannot be discovered at all. Among this last he places the cause of the hydrophobia.

He next proceeds to consider the symptoms of diseases. A symptom he defines to be "a preternatural affection depending upon a disease, or which follows it as a shadow does a body." He acknowledged three kinds of symptoms: the first and most considerable of these consisted in the action of the parts being injured or hindered; the second in a change of the quality of the parts, their actions in the mean time remaining entire; the third related to defects in point of excretion and retention.

After having treated of symptoms, Galen treats of the *signs* of diseases. These are divided into *diagnostic* and *prognostic*. The first are so called because they enable us to know diseases, and distinguish them from each other. They are of two sorts, *pathognomonic* and *adjunct*. The first are peculiar to every disease, make known its precise species, and always accompany it, so that they begin and end with it. The second are common to several diseases, and only serve to point out the difference between diseases of the same species. In a pleurisy, for instance, the pathognomonic signs are a cough, a difficulty of breathing, a pain of the side, and a continued fever; the adjunct signs are the various sorts of matter expectorated, which are sometimes bloody, sometimes bilious, &c. —The diagnostic signs were drawn from the defective or disordered disposition of the parts, or from the diseases themselves; secondly, from the causes of diseases; thirdly, from their symptoms; and lastly, from the particular dispositions of each body, from things which prove prejudicial and those that do service, and from epidemical diseases.—The prognostic signs he gathered from the species, virulence, and peculiar genius of the disease: but as we have already spoken so largely concerning the prognostics of Hippocrates, it is superfluous to be particular on those of Galen.—His method of cure differed little from that of Hippocrates: but from the specimen already given of Galen's method of teaching the medical art, it is evident that his system was little else than a collection of speculations, distinctions, and reasonings; whereas that of Hippocrates was founded immediately upon facts, which he had either observed himself, or had learned from the observation of others.

The system of Galen, however, notwithstanding its defects and absurdities, remained almost uncontradicted for a very long period. Indeed it may be considered as having been the prevailing system till the inundation of the Goths and Vandals put an almost entire stop to the cultivation of letters in Europe. But during the general prevalence of the system of Galen, there appeared some writers to whom medicine was indebted for improvements, at least in certain particulars. Among the most distinguished of these we may mention Oribasius, Ætius, Alexander, and Paulus.

42 Oribasius.

Oribasius flourished about the year 360, and was physician to the emperor Julian. He speaks very fully of the effects of bleeding by way of scarification, a thing little taken notice of by former writers; from his own experience he assures us that he had found it successful in a suppression of the menses, defluxions of the eyes, headach, and straitness of breathing even when the person was extremely old. He tells his own case particularly, when the plague raged in Asia, and he himself was taken ill, that the second day he scarified his leg, and took away two pounds of blood; by which means he entirely recovered, as did several others who used it. In this author also we find the first description of a surprising and terrible distemper, which he termed λυκανθρωπια, a species of melancholy and madness, which he describes thus. "The persons affected get out of their houses in the night-time, and in every thing imitate wolves, and wander among the sepulchres of the dead till day-break. You may know them by these symptoms: Their looks are pale; their eyes heavy, hollow, dry, without the least moisture of a tear; their tongue exceedingly parched and dry, no spittle in their mouth, extreme thirst; their legs, from the falls and the bruises they receive, full of incurable sores and ulcers."

43 Ætius.

Ætius lived very near the end of the fifth, or in the beginning of the sixth century. Many passages in his writings serve to show us how much the actual and potential cautery were used by the physicians of that age. In the palsy, he says, that he should not at all hesitate to make an eschar either way, and this in several places; one in the nape, where the spinal marrow takes its rise, two on each side of it; three or four on the top of the head, one just in the middle, and three others round it. He adds, that in this case, if the ulcers continue running a good while, he should not doubt of a perfect recovery. He is still more particular when he comes to order this application for an inveterate asthma, after all other remedies have been tried in vain. One, he says, should be made on each side near the middle of the joining of the clavicle, taking care not to touch the wind-pipe: two other little ones are then to be made near the carotids under the chin, one on each side, so that the caustic may penetrate no further than the skin; two others under the breasts, between the third and fourth ribs; and again, two more backwards towards the fifth and sixth ribs. Besides these there ought to be one in the middle

Ætius. middle of the thorax near the beginning of the xiphoid cartilage over the orifice of the ſtomach; one on each ſide between the eighth and ninth ribs; and three others in the back, one in the middle, and the two others juſt below it, on each ſide of the vertebræ. Thoſe below the neck ought to be pretty large, not very ſuperficial, not very deep: and all theſe ulcers ſhould be kept open for a very long time.

Ætius takes notice of the worms bred in different parts of the body called *dracunculi*, which were unknown to Galen. He ſeems alſo to be the firſt Greek writer among the Chriſtians, who gives us any ſpecimen of medicinal ſpells and charms; ſuch as that of a finger of St Blaſius for removing a bone which ſticks in the throat, and another in relation to a fiſtula. He gives a remedy for the gout, which he calls the *grand drier;* the patient is to uſe it for a whole year, and obſerve the following diet each month. "In September, he muſt eat and drink milk; In October, he muſt eat garlic; in November, abſtain from bathing; in December, he muſt eat no cabbage; in January, he is to take a glaſs of pure wine in the morning; in February, to eat no beet; in March, to mix ſweet things both in eatables and drinkables; in April, not to eat horſe-radiſh, nor in May the fiſh called *polypus;* in June, he is to drink cold water in a morning; in July, to avoid venery; and laſtly, in Auguſt, to eat no mallows." This may ſufficiently ſhow the quackery of thoſe times, and how ſuperſtition was begining to mix itſelf with the art.

44 Alexander. Alexander, who flouriſhed in the reign of Juſtinian, is a more original author than either of the two former. He confines himſelf directly to the tranſcribing the ſigns of diſeaſes, and the methods of cure, without meddling with anatomy, the materia medica, or ſurgery, as all the reſt did. He employs a whole book in treating of the gout. One method he takes of relieving this diſeaſe is by purging; and in moſt of the purges he recommends hermodactyls, of which he has a great opinion. In a cauſus, or burning fever, where the bile is predominant, the matter fit for evacuation, and the fever not violent, he prefers purging to bleeding, and ſays that he has often ordered purging in acute fevers with ſurpriſing ſucceſs. In the cauſus alſo, if a ſyncope happens from crude and redundant humours, he recommends bleeding. In ſyncope ſucceeding the ſuppreſſion of any uſual evacuation, he recommends bleeding, with frictions. The diagnoſtics upon which he founds this practice are the following: viz. a face paler and more ſwelled than uſual, a bloated habit of body, with a little ſluggiſh pulſe, having long intervals between the ſtrokes. In tertian, and much more in quartan fevers, he recommends vomits above all other remedies, and affirms that by this remedy alone he has cured the moſt inveterate quartans. On the bulimus, or canine appetite, he makes a new obſervation, viz. that it is ſometimes cauſed by worms. He mentions the caſe of a woman who laboured under this ravenous appetite, and had a perpetual gnawing at her ſtomach and pain in her head: after taking *bitra*, ſhe voided a worm above a dozen of cubits long, and was entirely cured of her complaints.—He is alſo the firſt author who takes notice of *rhubarb;* which he recommends in a weakneſs of the liver and dyſentry.—Alexander is recommended by Dr Freind as one of the beſt practical writers among the ancients, and well worthy the peruſal of any modern. Alexander.

45 Paulus. Paulus was born in the iſland Ægina, and lived in the 7th century. He tranſcribes a great deal from Alexander and other phyſicians. His deſcriptions are ſhort and accurate. He treats particularly of womens diſorders; and ſeems to be the firſt inſtance upon record of a profeſſed *man-midwife*, for ſo he was called by the Arabians: and accordingly he begins his book with the diſorders incident to pregnant women. He treats alſo very fully of ſurgery; and gives ſome directions, according to Dr Freind, not to be found in the more ancient writers.

46 Arabian Phyſicians. After the downfall of the Roman empire, and when the inundation of Goths and Vandals had almoſt completely exterminated literature of every kind in Europe, medicine, though a practical art, ſhared the ſame fate with more abſtract ſciences. Learning in general, baniſhed from the ſeat of arms, took refuge among the eaſtern nations, where the arts of peace ſtill continued to be cultivated. To the Arabian phyſicians, as they have been called, we are indebted both for the preſervation of medical ſcience, as it ſubſiſted among the Greeks and Romans, and likewiſe for the deſcription of ſome new diſeaſes, particularly the ſmall-pox. Among the moſt eminent of the Arabians, we may mention Rhaſes, Avicenna, Albucaſes, and Avenzoar. But of their writings it would be tedious, and is unneceſſary to give any particular account.—

47 Rhaſes. They were for the moſt part, indeed, only copiers of the Greeks; we are, however, indebted to them for ſome improvements. They were the firſt who introduced chemical remedies, though of theſe they uſed but few, nor did they make any conſiderable progreſs in the chemical art. Anatomy was not in the leaſt improved by them, nor did ſurgery receive any advancement till the time of Albucaſis, who lived probably in the 12th century. They added a great deal to botany and the materia medica, by the introduction of new drugs, of the aromatic kind eſpecially, from the eaſt, many of which are of conſiderable uſe. They alſo found out the way of making ſugar; and by help of that, ſyrups; which two new materials are of great uſe in mixing up compound medicines.

With regard to their practice, in ſome few particulars they deviated from the Greeks. Their purging medicines were much milder than thoſe formerly in uſe; and even when they did preſcribe the old ones, they gave them in a much leſs doſe than formerly. The ſame reflection may be made concerning their manner of bleeding, which was never to that exceſſive degree practiſed by the Greeks. They deviated from Hippocrates, however, in one very trivial circumſtance, which produced a violent controverſy. The queſtion was, Whether blood in a pleuriſy ought to be drawn from the arm of the affected ſide or the oppoſite? Hippocrates had directed it to be drawn from the arm of the affected ſide; but the Arabians, following ſome other ancient phyſicians, ordered it to be drawn from the oppoſite one. Such was the ignorance of thoſe ages, that the univerſity of Salamanca in Spain made a decree, that no one ſhould dare to let blood but in the contrary arm; and endeavoured to procure an edict from the emperor Charles V. to ſecond

it,

Arabian Physicians.

it; alleging that the other method was of no less pernicious consequence to medicine, than Luther's heresy had been to religion.

In consequence of the general decay of learning in the western parts of the world, the Greek writers became totally forgot, because nobody could read the language; and the Arabians, though mostly copiers from them, enjoyed all the reputation that was due to the others. The Arabian physic was introduced into Europe very early, with the most extravagant applause: and not only this, but other branches of their learning, came into repute in the west; insomuch that in the 11th century, the studies of natural philosophy and the liberal arts were called *the studies of the Saracens*. This was owing partly to the crusades undertaken against them by the European princes; and partly to the settlement of the Moors in Spain, and the intercourse they and other Arabians had with the Italians. For, long before the time of the crusades, probably in the middle of the 7th century, there were Hebrew, Arabic, and Latin professors of physic settled at Salernum; which place soon grew into such credit, that Charles the Great thought proper to found a college there in the year 802; the only one at that time in Europe. Constantine the African flourished here towards the latter end of the 11th century. He was a native of Carthage; but travelled into the east, and spent 30 years in Babylon and Bagdad, by which means he became master of the oriental languages and learning. He returned to Carthage; but being informed of an attempt against his life, made his escape into Apulia, where he was recommended to Robert Guiscard, created in 1060 duke of that country, who made him his secretary. He was reputed to be very well versed in the Greek, as well as the eastern tongues; and seems to have been the first who introduced either the Greek or Arabian physic into Italy. His works, however, contain nothing that is new, or material; though he was then counted a very learned man, and for that age no doubt was so.

48 College of Salernum.

49 Constantine.

50 State of medicine in the 14th and 16th centuries.

From this time to the end of the 15th and beginning of the 16th century, the history of physic furnishes us with no interesting particulars. This period, however, is famous for the introduction of chemistry into medicine, and the description of three new distempers, the sweating sickness, the venereal disease, and the scurvy. The sweating sickness began in 1483, in the army of Henry VII. upon his landing at Milford-haven, and spread itself at London from the 21st of September to the end of October. It returned here five times, and always in summer; first in 1485, then in 1506, afterwards in 1517, when it was so violent that it killed many in the space of three hours, so that numbers of the nobility died, and of the commonalty in several towns often the one half perished. It appeared the fourth time in 1528, and then proved mortal in six hours; many of the courtiers died of it, and Henry VIII. himself was in danger. In 1529, and only then, it infested the Netherlands and Germany, in which last country it did much mischief. The last return of it was in 1551, and in Westminster it carried off 120 in a day. Dr Caius describes it as a pestilent contagious fever, of the duration of one natural day; the sweat he reckoned to be only a natural sympton, or crisis of the distemper. It first affected some particular part, attended with inward heat and burning, unquenchable thirst, restlessness, sickness at stomach, but seldom vomiting, headach, delirium, then faintness, and excessive drowsiness. The pulse was quick and vehement, and the breath short and laborious.—Children, poor and old people, were less subject to it. Of others, scarce any escaped the attack, and most of them died. Even by travelling into France or Flanders they did not escape; and what is still more strange, the Scots were said not to be affected: abroad the English only were seized, and foreigners in England were free. At first the physicians were much puzzled how to treat this disease. The only cure they ever found, however, was to carry on the sweat for a long time; for, if it stopped, it was dangerous or fatal. The way, therefore, was for the patient to lie still, and not expose himself to cold. If nature was not strong enough to force out the sweat, it was necessary to assist her by art, with cloaths, wine, &c. The violence of the distemper was over in 15 hours; but there was no security for the patient till 24 were passed. In some strong constitutions there was a necessity to repeat the sweating, even to 12 times. The removing out of bed was attended with great danger; some who had not sweated enough fell into very ill fevers.—No flesh meat was to be allowed in all the time of the distemper; nor drink for the first five hours. In the seventh, the distemper increased; in the ninth the delirium came on, and sleep was by all means to be avoided. However terrible this distemper appeared at first, it seldom proved obstinate, if treated in the above-mentioned manner.

51 Sweating sickness in England.

Moderns.

In the beginning of the 16th century, the famous chemist Paracelsus introduced a new system into medicine, founded on the principles of his art. The Galenical system had prevailed till his time; but the practice had greatly degenerated, and was become quite trifling and frivolous. The physicians rejected the use of opium, mercury, and other efficacious remedies. Paracelsus, who made use of these, had therefore greatly the advantage over them; and now all things relating to medicine were explained on imaginary chemical principles. It will easily be conceived that a practice founded in this manner could be no other than the most dangerous quackery. At this time, however, it was necessary; for now a new disease over-ran the world, and threatened greater destruction than almost all the old ones put together, both by the violence of its symptoms, and its baffling the most powerful remedies at that time known.—This was the venereal disease, which is said to have been imported from the West-Indies by the companions of Christopher Columbus. Its first remarkable appearance was at the siege of Naples in 1494, from whence it was soon after propagated through Europe, Asia, and Africa. The symptoms with which it made the attack at that time were exceedingly violent, much more so than they are at present; and consequently were utterly unconquerable by the Galenists. The quacks and chemists, who boldly ventured upon mercury, though they no doubt destroyed numbers by their excessive use of it, yet showed that a remedy for this terrible distemper was at last found out, and that a proper method of treating it might soon be fallen upon. Shortly after, the West-Indian specific, guaiacum,

52 Paracelsus.

53 Appearance of the venereal disease.

Moderns.

cum, was discovered: the materia medica was enriched with that and many other valuable medicines, both from the East and West-Indies: which contributed considerably to the improvement of the practice of physic. At this period, as sea voyages of considerable duration became more frequent, the scurvy became a more frequent distemper, and was of course more accurately described. But probably, from supposed analogy to the contagions which at that time were new in Europe, very erroneous ideas were entertained with regard to its being of an infectious nature: And it is not impossible, that from its being attended also with ulcers, it was on some occasions confounded with syphilitic complaints.

54 Progress of medicine in the 17th and 18th centuries.

The revival of learning, which now took place throughout Europe, the appearance of these new distempers, and the natural fondness of mankind for novelty, contributed greatly to promote the advancement of medicine as well as other sciences. While at the same time, the introduction of the art of printing rendered the communication of new opinions as well as new practices so easy a matter, that to enumerate even the names of those who have been justly rendered eminent for medical knowledge would be a very tedious task. It was not, however, till 1628 that Dr William Harvey of London demonstrated and communicated to the public one of the most important discoveries respecting the animal economy, the circulation of the blood. This discovery, more effectually than any reasoning, overturned all the systems which had subsisted prior to that time. It may justly be reckoned the most important discovery that has hitherto been made in the healing art: for there can be no doubt that it puts the explanation of the phenomena of the animal body, both in a state of health and disease, on a more solid and rational footing than formerly. It has not, however, prevented the rise of numerous fanciful and absurd systems. These, though fashionable for a short time, and strenuously supported by blind adherents, have yet in no long period fallen into deserved contempt. And notwithstanding the abilities and industry of Stahl, Hoffman, Boerhaave, and Cullen, we may easily venture to assert that no general system has yet been proposed which is not liable to innumerable and unsurmountable objections. Very great progress has indeed been made in explaining the philosophy of the human body, from ascertaining by decisive experiment the influence of the circulating, the nervous, and the lymphatic systems in the animal economy. But every attempt hitherto made to establish any general theory in medicine, that is to conduct the cure of every disease on a few general principles, has equally deviated from truth with those of Hippocrates and Galen; and has equally tended to mislead those who have adopted it. Indeed we may with confidence venture to assert, that from the very nature of the subject itself, medicine does not admit of such simplicity. No one can deny that the human body consists of a very great number of different parts both solids and fluids. It is, however, equally certain, that each of these is from many different causes liable to deviations from the sound state. And although some slight changes may take place without what can be called a morbid affection, yet we well know, that every change taking place to a certain degree in any one part will necessarily and unavoidably produce an affection of the whole. Hence we may without hesitation venture to affirm, that every general theory which can be proposed, attempting to explain the phenomena, and conduct the cure of all diseases on a few general principles, though for some time it may have strenuous advocates, will yet in the end be found to be both ill-grounded and pernicious.

55 Discovery of the circulation.

The art of medicine has been much more usefully improved by careful attention to the history, theory, and practice of particular diseases, and by endeavouring to ascertain from cautious observations the symptoms by which they are to be distinguished, the causes by which they are induced, and the means by which they are to be prevented, alleviated, or cured. On this footing, therefore, we shall endeavour to give a brief account of at least the most important affections to which the human body is subjected, delivering what appear to us to be the best established facts and observations respecting each.

But before entering on the consideration of particular diseases, on what has commonly been styled the practice of medicine, it is necessary to give a general view of the most important functions of the animal body, and of the chief morbid affections to which they are subjected; a branch which has usually been named the *Theory* or *Institutions of Medicine*.

Theory of Medicine, or an Account of the principal Functions of the Animal Body.

56 Division of the functions to animal, vital, and natural.

While the functions of living animals, but particularly of the human species, are very numerous, the accounts given of these both in a state of health and disease are very various. Without therefore pretending to enumerate the contradictory opinions of different authors, we shall here present the reader with a view of this subject, extracted from one of the latest and best publications respecting it, the *Conspectus Medicinæ Theoreticæ* of Dr James Gregory, formerly professor of the institutions of medicine in the university of Edinburgh, and now professor of practice.

In this work, which was first published in 1780, and afterwards reprinted under an enlarged form in 1782, Dr. Gregory introduces his subject by observing, that some functions of the human body relate to itself only, and others to external things. To the latter class belong those which by physicians are called the *animal functions*; to which are to be referred all our senses, as well as the power of voluntary motion, by which we become acquainted with the universe, and enjoy this earth. Among the functions which relate to the body, only some have been named *vital*, such as the circulation of the blood and respiration; because, without the constant continuance of these life cannot subsist. Others, intended for repairing the waste of the system, have been termed the *natural functions*;

Division of functions.

tions: for by the conſtant attrition of the ſolids, and the evaporation of the fluid parts of the body, we ſtand in need of nouriſhment to ſupply this waſte; after which the putrid and excrementitious parts muſt be thrown out by the proper paſſages. The digeſtion of the food, ſecretion of the humours, and excretion of the putrid parts of the food, are referred to this claſs; which, though neceſſary to life, may yet be interrupted for a conſiderable time without danger.

57 Diſtinction of diſeaſes into ſimple and compound.

A *diſeaſe* takes place, when the body has ſo far declined from a ſound ſtate, that its functions are either quite impeded, or performed with difficulty. A diſeaſe therefore may happen to any part of the body either ſolid or fluid, or to any one of the functions: and thoſe may occur either ſingle, or ſeveral of them joined together; whence the diſtinction of diſeaſes into *ſimple* and *compound.*

We have examples of the moſt ſimple kinds of diſeaſes, in the rupture or other injury of any of the corporeal organs, by which means they become leſs fit for performing their offices; or, though the organs themſelves ſhould remain ſound, if the ſolids or fluids have degenerated from a healthy ſtate; or if, having loſt their proper qualities, they have acquired others of a different, perhaps of a noxious nature; or laſtly, if the moving powers ſhall become too weak or too ſtrong, or direct their force in a way contrary to what nature requires.

58 Symptoms.

The moſt ſimple diſeaſes are either productive of others, or of *ſymptoms*, by which alone they become known to us.—Every thing in which a ſick perſon is obſerved to differ from one in health is called a *ſymptom;* and the moſt remarkable of theſe ſymptoms, and which moſt conſtantly appear, define and conſtitute the diſeaſe.

The cauſes of diſeaſes are various; often obſcure, and ſometimes totally unknown. The moſt full and perfect proximate cauſe is that which, when preſent, produces a diſeaſe, when taken away removes it, and when changed alſo changes it.—There are alſo remote cauſes, which phyſicians have been accuſtomed to divide into the *predipoſonent* and *exciting* ones. The former are thoſe which only render the body fit for a diſeaſe, or which put it into ſuch a ſtate that it will readily receive one. The exciting cauſe is that which immediately produces the diſeaſe in a body already diſpoſed to receive it.

59 Predipoſonent cauſe.

60 Exciting cauſe.

The predipoſonent cauſe is always inherent in the body itſelf, though perhaps it originally came from without; but the exciting cauſe may either come from within or from without.

From the combined action of the predipoſonent and exciting cauſes comes the *proximate* cauſe, which neither of the two taken ſingly is able to produce; ſeeing neither every exciting cauſe will produce a diſeaſe in every perſon, nor will every one predipoſed to a diſeaſe fall into it without an exciting cauſe.—A body predipoſed to diſeaſe therefore has already declined ſomewhat from a ſtate of perfect health, although none of its functions are impeded in ſuch a manner that we can truly ſay the perſon is diſeaſed. Yet ſometimes the predipoſonent cauſe, by continuing long, may arrive at ſuch an height, that it alone, without the addition of any exciting cauſe, may produce a real diſeaſe.—Of this we have examples in the debility of the ſimple ſolids, the mobility of the living ſolids, and in plethora.—The exciting cauſe alſo, though it ſhould not be able immediately to bring on a diſeaſe; yet if it continues long, will by degrees deſtroy the ſtrongeſt conſtitution, and render it liable to various diſeaſes; becauſe it either produces a predipoſonent cauſe, or is converted into it, ſo that the ſame thing may ſometimes be an exciting cauſe, ſometimes a predipoſonent one; of which the inclemencies of the weather, ſloth, luxury, &c. are examples.

61 Proximate cauſe.

Origin of Diſeaſes.

62 Hereditary diſeaſes.

Diſeaſes, however, ſeem undoubtedly to have their origin from the very conſtitution of the animal machine; and hence many diſeaſes are common to every body when a proper exciting cauſe occurs, though ſome people are much more liable to certain diſeaſes than others. Some are hereditary; for as healthy parents naturally produce healthy children, ſo diſeaſed parents as naturally produce a diſeaſed offſpring. Some of theſe diſeaſes appear in the earlieſt infancy; others occur equally at all ages; nor are there wanting ſome which lurk unſuſpected even to the lateſt old age, at laſt breaking out with the utmoſt violence on a proper occaſion. Some diſeaſes are born with us, even though they have no proper foundation in our conſtitution, as when a fœtus receives ſome hurt by an injury done to the mother; while others, neither born with us nor having any foundation in the conſtitution, are ſucked in with the nurſe's milk. Many diſeaſes accompany the different ſtages of life; and hence ſome are proper to infancy, youth, and old age. Some alſo are proper to each of the ſexes: eſpecially the weaker ſex, proceeding, no doubt, from the general conſtitution of the body, but particularly from the ſtate of the parts ſubſervient to generation. Hence the diſeaſes peculiar to virgins, to menſtruating women, to women with child, to lying-in-women, to nurſes, and to old women. The climate itſelf, under which people live, produces ſome diſeaſes; and every climate hath a tendency to produce a particular diſeaſe, either from its exceſs of heat or cold, or from the mutability of the weather. An immenſe number of diſeaſes may be produced by impure air, or ſuch as is loaded with putrid, marſhy, and other noxious vapours. The ſame thing may happen likewiſe from corrupted aliment, whether meat or drink; though even the beſt and moſt nutritious aliment will hurt if taken in too great quantity; not to mention poiſons, which are endowed with ſuch pernicious qualities, that even when taken in a very ſmall quantity they produce the moſt grievous diſeaſes, or perhaps even death itſelf. Laſtly, from innumerable accidents and dangers to which mankind are expoſed, they frequently come off with broken limbs, wounds, and contuſions, ſometimes quite incurable; and theſe misfortunes, though proceeding from an external cauſe at firſt, often terminate in internal diſeaſes.

65 Diſeaſes from age and ſex.

64 Diſeaſes from climate.

65 Diſeaſes from accidents.

Hitherto we have mentioned only the dangers which come from without; but thoſe are not leſs, nor fewer in number, which come from within. At every breath, man pours forth a deadly poiſon both to himſelf and others. Neither are the effluvia of the lungs alone hurtful: there flows out from every pore of the body a moſt ſubtile and poiſonous matter, perhaps of a putre-

Origin of Diseases.

ſcent nature, which being long accumulated, and not allowed to diffuſe itſelf through the air, infects the body with moſt grievous diſeaſes; nor does it ſtop here, but produces a contagion which ſpreads devaſtation far and wide among mankind. From too much or too little exerciſe of our animal-powers alſo no ſmall danger enſues. By inactivity either of body or mind, the vigour of both is impaired; nor is the danger much leſs from too great employment. By moderate uſe, all the faculties of the mind, as well as all the parts of the body, are improved and ſtrengthened; and here nature has appointed certain limits ſo that exerciſe can neither be too much neglected, nor too much increaſed, with impunity. Hence thoſe who uſe violent exerciſe, as well as thoſe who ſpend their time in ſloth and idolneſs, are equally liable to diſeaſes: but each to diſeaſes, of a different kind; and hence alſo the bad effects of too great or too little employment of the mental powers.

66 Diſeaſes from paſſions of the mind.

Beſides the dangers ariſing from thoſe actions of the body and mind which are in our own power, there are others ariſing from thoſe which are quite involuntary. Thus, paſſions of the mind, either when carried to too great exceſs, or when long continued, equally deſtroy the health: nay, will even ſometimes bring on ſudden death. Sleep alſo, which is of the greateſt ſervice in reſtoring the exhauſted ſtrength of the body, proves noxious either by its too great or too little quantity. In the moſt healthy body, alſo, many things always require to be evacuated. The retention of theſe is hurtful, as well as too profuſe an evacuation, or the excretion of thoſe things either ſpontaneouſly or artificially which nature directs to be retained. As the ſolid parts ſometimes become flabby, ſoft, almoſt diſſolved, and unfit for their proper offices; ſo the fluids are ſometimes inſpiſſated, and formed even into the hardeſt ſolid maſſes. Hence impeded actions of the organs, vehement pain, various and grievous diſeaſes. Laſtly, ſome animals are to be reckoned among the cauſes of the diſeaſes: namely ſuch as ſupport life at the expence of others: and theſe either invade us from without, or take up their reſidence within the body, gnawing the bowels while the perſon is yet alive, not only with great danger and diſtreſs to the patient, but ſometimes even producing death itſelf.

67 *Vis medicatrix naturæ.*

Man, however, is not left without defence againſt ſo many and ſo great dangers. The human body is poſſeſſed of a moſt wonderful power, by which it preſerves itſelf from diſeaſes, keeps off many, and in a very ſhort time cures ſome already began, while others are by the ſame means more ſlowly brought to a happy concluſion. This power, called the *autocrateia*, or *vis medicatrix naturæ*, is well known both to phyſicians and philoſophers, by whom it is moſt juſtly celebrated; this alone is ſufficient for curing many diſeaſes, and is of ſervice in all. Nay, even the beſt medicines operate only by exciting and properly directing this force; for no medicine will act on a dead carcaſe. But though phyſicians juſtly put confidence in this power, and though it generally cures diſeaſes of a ſlighter nature, it is not to be thought that thoſe of the more grievous kind are to be left to the unaſſiſted efforts of the *vis medicatrix*. Phyſicians therefore have a twofold error to avoid, namely, either deſpiſing the powers of nature too much, or putting too great confidence in them; becauſe in many diſeaſes theſe efforts are either too feeble or too violent, inſomuch that ſometimes they are more to be dreaded than even the diſeaſe itſelf. So far therefore is it from being the duty of a phyſician always to follow the footſteps of Nature, that it is often neceſſary for him to take a directly contrary courſe, and oppoſe her efforts with all his might.

68 Chemical analyſis of the animal ſolids.

After this general view of the functions of the animal body, of the nature and cauſes of diſeaſes, and of the powers by which theſe are to be combated, Dr Gregory proceeds to treat of the ſolid materials of which the body is formed. He tells us, that the animal ſolid, when chemically examined, yields earth, oil, ſalt, water, phlogiſton or inflammable air, and a great quantity of mephitic air. Theſe elements are found in various proportions in the different parts of the body; and hence theſe parts are endowed with very different mechanical powers, from the hardeſt and moſt ſolid bone to the ſoft and almoſt fluid retina. Nay, it is principally in this difference of proportion between the quantities of the different elements, that the difference between the ſolid and fluid parts of the animal conſiſt, the former having much more earth and leſs water in their compoſition than the latter. The coheſion, he thinks, is owing to ſomething like a chemical attraction of the elements for one another; and its cauſe is neither to be ſought for in the gluten, fixed air, nor earth. This attraction, however, is not ſo ſtrong but that even during life the body tends to diſſolution; and immediately after death putrefaction commences, provided only there be as much moiſture in it as will allow an inteſtine motion to go on. The greater the heat, the ſooner does putrefaction take place, and with the greater rapidity does it proceed; the mephitic air flies off, and together with it certain ſaline particles; after which, the coheſion of the body being totally deſtroyed, the whole falls into a putrid colluvies, of which at length all the volatile parts being diſſipated, nothing but the earth is left behind.

This analyſis, he owns, is far from being perfect; becauſe nobody has ever been able, by combining the chemical principles of fleſh, to reproduce a compound any thing like what the fleſh originally was; but, however imperfect the analyſis may be, it ſtill has the advantage of ſhowing in ſome meaſure the nature and cauſes of certain diſeaſes, and thus leads phyſicians to the knowledge of proper remedies.

69 Qualities of the animal ſolids.

The ſolid parts are fitted for the purpoſes of life in three ſeveral ways; namely, by their coheſion, their flexibility, and their elaſticity, all of which are various in the various parts of the body. Moſt of the functions of life conſiſt in various motions. In ſome the moſt violent and powerful motions are required; and therefore ſuch a degree of coheſion is neceſſary in thoſe parts as will be ſufficient for allowing them to perform their offices without any danger of laceration. It is therefore neceſſary that ſome of the ſolid parts ſhould be more flexible than others; and it is likewiſe neceſſary that theſe parts, along with their flexibility, ſhould have a power of recovering their former ſhape and ſituation, after the removal of the force by which they were altered.

Theſe variations in flexibility, within certain limits,

Qualities of the Animal Solids.

mits, ſeldom produce any material conſequence with regard to the health: though ſometimes, by exceeding the proper bounds, they may bring on real and very dangerous diſeaſes; and this either by an exceſs or diminution of their coheſion, flexibility, or elaſticity. By augmenting the coheſion, the elaſticity is alſo for the moſt part augmented, but the flexibility diminiſhed; by diminiſhing the coheſion, the flexibility becomes greater, but the elaſticity is diminiſhed.

The cauſes of theſe affections, though various, may be reduced to the following heads. Either the chemical compoſition of the matter itſelf is changed: or, the compoſition remaining the ſame, the particles of the ſolid may be ſo diſpoſed, that they ſhall more or leſs ſtrongly attract one another. As to the compoſition, almoſt all the elements may exiſt in the body in an undue proportion, and thus each contribute its ſhare to the general diſorder. But of many of theſe things we know very little; only it is apparent, that the fluid parts, which conſiſt chiefly of water, and the ſolid, which are made up of various elements are often in very different proportions; the more water, the leſs is the coheſion or elaſticity, but the greater the flexibility; and the reverſe happens, if the ſolid or earthy part predominates.

70 Cauſes affecting the ſolids.

The remote cauſes of theſe different ſtates, whether prediſponent or exciting, are very various. In the firſt place, idioſyncraſy itſelf, or the innate conſtitution of the body, contributes very much to produce the above-mentioned effects. Some have naturally a much harder and drier temperament of the body than others; men, for inſtance, more than women; which can with the utmoſt difficulty, indeed ſcarce by any means whatever, admit of an alteration. The ſame thing takes place at different periods of life; for, from firſt to laſt, the human body becomes always drier and more rigid. Much alſo depends on the diet made uſe of, which always produces a correſponding ſtate of the ſolids in proportion to its being more or leſs watery. Neither are there wanting ſtrong reaſons for believing, that not only the habit of the body, but even the diſpoſition of the mind, depends very much on the diet we make uſe of. The good or bad concoction of the aliment, alſo the application of the nouriſhment prepared from it, and likewiſe the ſtate of the air with regard to moiſture or dryneſs, affects the temperament of the body not a little; and hence thoſe who inhabit mountains or dry countries, are very different from the inhabitants of low marſhy places. Laſtly, the manner of living contributes ſomewhat to this effect: Exerciſe preſſes out and exhales the moiſture of the body, if in too great quantity; on the contrary ſloth and lazineſs produce an effect directly oppoſite, and cauſe a redundancy of humour.

But, putting the chemical compoſition of the ſolid parts out of the queſtion altogether, they may be affected by many other cauſes. The condenſation, for inſtance, or compreſſion of the particles, whether by mechanical cauſes or by means of cold or heat, makes a conſiderable alteration in the ſtrength and elaſticity of every ſolid body. How much mechanical preſſure contributes to this may be underſtood from the experiments of Sir Clifton Wintringham; and hence alſo are we to deduce the reaſon of many facts of the higheſt importance in the animal economy; namely, the growth, ſtate, decreaſe of the body; its rigidity daily increaſing; and at laſt the unavoidable death incident to old age from a continuance of the ſame cauſes.

Perhaps the different denſity of the ſolids is in ſome meaſure owing to Nature herſelf; but it ſeems rather to depend more on the powers of exerciſe or inactivity in changing the ſtate of the ſolids, the effects of which on the body, whether good or bad, may hence be eaſily underſtood.

Heat relaxes and expands all bodies, but cold renders them more denſe and hard; the effects of which on the human body are well known to moſt people. Though the body is found to preſerve a certain degree of heat almoſt in every ſituation, it is impoſſible but that its ſurface muſt be affected by the temperature of the ambient atmoſphere: and we have not the leaſt reaſon to doubt that every part of the body may thus feel the effects of that temperature. What a difference is there between one who, expoſed to the ſouth-wind, becomes lazy and languid, ſcarce able to drag along his limbs; and one who feels the force of the cold north-wind, which renders the whole body alert, ſtrong, and fit for action?

That theſe various cauſes, each of which is capable of affecting the conſtitution of the body when taken ſingly, will produce much greater effects when combined, is ſufficiently evident. The experiments of Bryan Robinſon, the effects of the warm bath, and indeed daily experience, ſhow it fully.

It is not yet certainly known what is the ultimate ſtructure of the minuteſt parts of the animal-ſolid; whether it conſiſts of ſtraight fibres or threads, whoſe length is very conſiderable in proportion to their breadth, variouſly interwoven with one another, as Boerhaave ſuppoſes; or of ſpiral ones, admirably convoluted and interwoven with one another, as ſome microſcopical experiments ſeem to ſhow, or whether the cellular texture be formed of fibres and *laminæ*, and from thence the greateſt part of the body, as the celebrated Haller hath endeavoured to prove.

71 Cellular texture.

The cellular texture is obſerved throughout the whole body: it ſurrounds and connects the fibres themſelves, which are ſufficiently apparent in many of the organs; and ſlightly joins the different parts which ought to have any kind of motion upon the neighbouring ones. By a condenſation of the ſame ſubſtance alſo, the ſtrongeſt, and what ſeem the thinneſt, membranes are formed; the moſt ſimple of which, being accurately examined, diſcover the cellular ſtructure. This cellular ſubſtance ſometimes increaſes to a ſurpriſing degree, and all parts formed of it, membranes, veſſels, &c. eſpecially by a gentle diſtenſion; for a ſudden and violent diſtenſion either breaks it altogether, or renders it thinner. Sometimes alſo it grows between neighbouring parts, and joins theſe which nature has left free. Preternatural concretions of this kind are often obſerved after an inflammation of the lungs or of the abdominal viſcera; and theſe new membranes are found to be truly cellular. This ſubſtance, when cut, or by any other means divided, grows together of its own accord; but if, by reaſon of very great inflammation and ſuppuration, a large portion of the cellular texture has been deſtroyed, it is never again renewed, and an ugly ſcar is left. It is even

ſaid,

Cellular Texture.

said, that this substance, in certain cases, is capable of joining the parts either of the same body with one another, or of a foreign body with them; and upon this, if on any foundation, rests the art of Taliacotius and that of transplanting teeth, lately so much talked of.

The cellular texture is in some places merely a kind of net-work, in others filled with fat. Wherever too great bulk or compression would have been inconvenient or dangerous, as in the head, lungs, eyes, eyebrows, penis, scrotum, &c. there it collects no fat, but is lax, and purely reticulated; but between the muscles of the body and limbs below the skin, in the abdomen, especially in the omentum and about the kidneys, very much fat is secreted and collected.

72 Animal fat.

The fat is a pure animal oil, not very different from the expressed and mild vegetable ones; during life it is fluid, but of different degrees of thickness in different parts of the body. It is secreted from the blood, and is often suddenly reabsorbed into it, though pure oil is very rarely observed in the blood. It is indeed very probable, that oil, by digestion, partly in the primæ viæ, and partly in the lungs, is converted into gluten, and this again into oil by means of secretion; though no organs secreting the fat can be shown by anatomists. It is, however, probable, that there are such organs; and that the cellular texture has some peculiar structure in those parts which are destined to contain the fat already secreted, without suffering it to pass into other places; for it never passes into those parts which are purely reticulated, although the cellular texture is easily permeable by air or water over the whole body from head to foot.

The fat is augmented by the use of much animal-food, or of any other that is oily and nourishing, provided the digestion be good; by the use of strong drink, especially malt-liquor; by much rest of body and mind, much sleep and inactivity, castration, cold, repeated bloodletting, and in general by whatever diminishes the vital and animal powers. Much, however, depends on the constitution of the body itself; nor is it possible to fatten a human creature at pleasure like an ox. A certain degree of fatness, according to the age of the person, is a sign and effect of good health; but when too great, it becomes a disease of itself, and the cause of other diseases. It may always be very certainly removed by strong exercise, little sleep, and a spare and solid diet. The fat always makes up a considerable part of the bulk of the body, and very often by far the greatest part. Its use seems to be to make the motion of the body more easy and free by lessening the friction of the moving parts, and thus preventing the abrasion of the solids, which would otherwise happen. It is also of use to hinder the parts from growing together, which sometimes happens, when by an ulcer or any other accident a part of the cellular texture containing the fat is destroyed. Besides all this, the fat contributes not a little to the beauty of the body, by filling up the large interstices between the muscles, which would otherwise give the person a deformed and shocking appearance. It is thought to be nutritious, when absorbed from its cells by the blood; but of this we have no great certainty. It seems to have some power of defending from the cold, seeing nature has bestowed it in very great quantity on those animals which inhabit the colder regions.

Animal Fat.

73 Vital solids.

Those parts of the body which enjoy sense and mobility, are called *living* or *vital* solids. They are the brain, cerebellum, medulla oblongata, spinal marrow, the nerves arising from these and diffused throughout the whole body, and which are distributed through the various organs of sense and through the muscles, and lastly the muscles themselves. Sensation is much more general than mobility, as being common to all the parts already mentioned. Mobility is proper to the muscular fibres alone: wherever there is sensation, therefore, we may believe that there are nerves; and wherever there is mobility, we may believe that muscular fibres exist. Nay, even mobility itself seems to originate from the connection which the muscles have with the nerves; for soon after the nerves are compressed, or tied, or cut, the muscles to which they are distributed lose their faculties; which happens, too, when the brain itself, or the origin of the nerves, is affected. Some reckon that the muscles are produced from the nerves, and consist of the same kind of matter. Both indeed have a similar structure, as being fibrous and of a white colour: for the muscles when well freed from the blood, of which they contain a great abundance, are of this colour as well as the nerves; neither can the nervous fibres by any means be distinguished from the muscular fibres themselves. Both have also sensation; and both stimulants and sedatives act in the same manner, whether they be applied to the muscles themselves or to the nerves.

It is difficult for us to discover the origin of many parts of the body, or to ascertain whether they are produced all at the same time or one after another: yet it must be owned, that many of the muscular parts are observed to have attained a remarkable degree of strength, while the brain is still soft and almost fluid: and that the action of these muscular parts is required for the action and growth of the brain. The muscles are also of a much firmer contexture than the nerves; and enjoy a power of their own, namely, that of irritability, of which the nerves never participate. Of necessity, therefore, either the muscles must be constructed of some kind of matter different from that of the nerves; or if both are made of the same materials, their organization must be exceedingly different. But if the substance of the muscles and nerves be totally different, we may easily be convinced that much of the one is always mixed with the other; for it is impossible to prick a muscle even with the smallest needle, without wounding or lacerating many nervous fibres at the same time. Since, therefore, there is such a close connection between the muscles and nerves both as to their functions and structure, they are deservedly reckoned by physiologists to be parts of the same genus, called the *genus nervosum*, or *nervous system*.

74 Sense of feeling.

After treating of sense in general, Dr Gregory proceeds to consider particularly each of the senses both external and internal. He begins with the sense of feeling, as being the most simple, and at the same time in common to every part of the nervous system. In some places, however, it is much more acute than in others; in the skin, for instance,

External Senses.

ſtance, and eſpecially in the points of the fingers. Theſe are reckoned to have *nervous papillæ*, which by the influx of the blood are ſomewhat erected in the action of contact, in order to give a more acute ſenſation; though indeed this opinion ſeems rather to be founded on a conjecture derived from the ſtructure of the tongue, which is not only the organ of taſte, but alſo a moſt delicate organ of touch, than upon any certain obſervations.

75 Pain.

From the ſenſe of feeling, as well as all the other ſenſes, either pain or pleaſure may ariſe; nay, to this ſenſe we commonly refer both pain and almoſt all other troubleſome ſenſations, tho' in truth pain may ariſe from every vehement ſenſation. It is brought on by any great force applied to the ſentient part; whether this force comes from within or from without. Whatever, therefore, pricks, cuts, lacerates, diſtends, compreſſes bruiſes, ſtrikes, gnaws, burns, or in any manner of way ſtimulates, may create pain. Hence it is ſo frequently conjoined with ſo many diſeaſes, and is often more intolerable even than the diſeaſe itſelf. A moderate degree of pain ſtimulates the affected part, and by degrees the whole body; produces a greater flux of blood and nervous power to the part affected; and often ſtimulates to ſuch motions as are both neceſſary and healthful. Hence, pain is ſometimes to be reckoned among thoſe things which guard our life. When very violent, however, it produces too great irritation, inflammation and its conſequences, fever, and all thoſe evils which flow from too great force of the circulation; it diſorders the whole nervous ſyſtem, and produces ſpaſms, watching, convulſions, delirium, debility, and fainting. Neither the mind nor body can long bear very vehement pain; and indeed Nature has appointed certain limits, beyond which ſhe will not permit pain to be carried, without bringing on delirium, convulſions, ſyncope, or even death, to reſcue the miſerable ſufferer from his torments.

Long continued pain, even though in a more gentle degree, often brings on debility, torpor, palſy, and rigidity of the affected part. But if not too violent, nor accompanied with fever, ſickneſs, or anxiety, it ſometimes ſeems to contribute to the clearneſs and acuteneſs of the judgment, as ſome people teſtify who have been afflicted with the gout.

76 Anxiety.

Anxiety is another diſagreeable ſenſation, quite different from pain, as being more obtuſe and leſs capable of being referred to any particular part, though frequently more intolerable than any pain. But we muſt take care to diſtinguiſh between this anxiety of which we treat in a medical ſenſe, and that which is ſpoken of in common diſcourſe. The latter does not at all depend on the ſtate of the body, but belongs entirely to the mind; and ariſes from a ſenſe of danger, or a foreſight of any misfortune. The former is truly corporeal; and derives, no leſs than pain, its origin from a certain ſtate of the body. Notwithſtanding this difference, however, it is very poſſible for both theſe kinds of anxiety to be preſent at the ſame time, or for the one to be the cauſe of the other. A very great bodily anxiety will ſtrike fear and deſpondency into the moſt reſolute mind; and mental anxiety, on the contrary, if very violent and long-continued, may induce the former, by deſtroying the powers of the body, eſpecially thoſe which promote the circulation of the blood.

Anxiety, in the medical ſenſe of the word, ariſes in the firſt place from every cauſe diſturbing or impeding the motion of the blood through the heart and large veſſels near it. Anxiety, therefore, may ariſe from many diſeaſes of the heart and its veſſels, ſuch as its enlargement, too great conſtriction, oſſification, polypus, palpitation, ſyncope, inflammation, debility, and alſo ſome affections of the mind. It is likewiſe produced by every difficulty of breathing, from whatever cauſe it may ariſe; becauſe then the blood paſſes leſs freely through the lungs: anxiety of this kind is felt deep in the breaſt. It is ſaid alſo to ariſe from the difficult paſſage of the blood through the liver or other abdominal viſcera.

A certain kind of anxiety is very common and troubleſome to hypochondriacal people; and ariſes from the ſtomach and inteſtines being either loaded with indigeſted and corrupted food, or diſtended with air produced by fermentation and extricated from the aliments. By ſuch a load, or diſtenſion, the ſtomach, which is a very delicate organ, becomes greatly affected. Beſides, the free deſcent of the diaphragm is thus hindered, and reſpiration obſtructed. Anxiety of this kind is uſually very much and ſuddenly relieved by the expulſion of the air; by which, as well as by other ſigns of a bad digeſtion, it is eaſily known. In theſe caſes the anxiety is uſually, though with little accuracy, referred to the ſtomach.

Anxiety alſo frequently accompanies fevers of every kind, ſometimes in a greater and ſometimes in a leſſer degree. In this caſe it ariſes as well from the general debility as from the blood being driven from the ſurface of the body and accumulated in the large veſſels; as in the beginning of an intermittent fever. Or it may ariſe from an affection of the ſtomach when overloaded with crude, corrupted aliment; or diſtended and naufeated with too much drink, eſpecially medicated drink. As the fever increaſes, the anxiety of the patient becomes greater and greater; remarkably ſo, according to the teſtimony of phyſicians, either immediately before the criſis or on the night preceding it; as before the breaking out of exanthemata, hæmorrhagy, ſweat, or diarrhœa, which ſometimes remove fevers. The patient feels likewiſe an anxiety from the ſtriking in of any eruption or critical metaſtaſis. This ſenſation alſo accompanies fevers and moſt other diſeaſes, when the vital power is exhauſted, and death approaches, of which it is the forerunner and the ſign. It happens at that time, becauſe the vital powers, unable to perform their functions, cannot make the blood circulate. But what kind of anxiety this is, the other ſigns of approaching death ſhows very evidently. Moreover, in the time of ſleep, anxiety may ariſe from the ſame cauſes: hence frightful dreams, which frequently diſturb our repoſe with ſurpriſe and terror.

77 Itching.

Itching, an uneaſy ſenſation, with a deſire of ſcratching the place affected, is often very troubleſome, altho' it ſeems to be more a-kin to pleaſure than to pain. As pain proceeds from too great an irritation, either chemical or mechanical, ſo does itching proceed from a ſlight one. Titillation, or friction, of a woollen ſhirt,

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for instance, upon the skin of a person unaccustomed to it, and of a delicate constitution, excites itching; as do also many acrid fossils, vegetables, and animals. Hence an itching is the first sensation after the application of cantharides, although the same, when augmented, becomes painful. The same effect is produced by any thing acrid thrown out upon the skin; as in exanthematic fevers, the disease called the *itch*, &c. Lice, worms, especially ascarides, irritating either the skin or the intestines, excite a troublesome itching. Certain species of internal itching excites people to many necessary actions both in a diseased and healthy state; such as the excretion of the fæces and urine, coughing, sneezing, and the like.

Too acute a sensation over the whole body is very rarely if ever observed. In a particular part the sense of feeling is often more acute than it ought to be, either from the cuticle itself being too thin and soft, or being removed; or from the part itself being inflamed, or exposed to too great heat. It becomes obtuse, or is even quite destroyed over the whole body, or in great part of it, from various affections of the brain and nerves; as when they are wounded, compressed, or defective in vital power. This is called *anaesthesia*, and sometimes accompanies palsy.

This sense may be deficient in a particular part, either from the nerve being diseased, or from its being compressed or wounded, or from the part itself being exposed to too great a degree of cold;—or from the scarf-skin which covers it being vitiated, either becoming too thick or hard, by the handling of too rough, or hard, or hot bodies, as is the case with glass-makers and smiths; or from the elevation of the cuticle from the subjacent cutis, or true skin itself, by the interposition of blood, serum, or pus; or from the cutis being macerated, relaxed, or become torpid, which sometimes happens to hydropic persons; or lastly, from the whole organ being corrupted by gangrene, burning, cold, or contusion. This sense is very rarely depraved, unless perhaps in the case of delirium, when all the functions of the brain are disturbed in a surprising manner.

78 Taste.

The sense next to be considered is that of taste, the principal organ of which is the tongue; the nearer the tip of it, the more acute is the sense, and the nearer the glottis so much the more obtuse. It must be owned, however, that some kind of acrid substances, the taste of which is scarce perceived upon the tip of the tongue, excite a most vehement sensation about its roots, or even in the throat itself. The tongue is endowed with many large and beautiful nervous papillæ, which seem to be the chief seat of this sense, and in the act of tasting are elevated and erected, in order to give the more acute sensation.

Nothing can be tasted which is not soluble in the saliva, that, being applied in a fluid form, it may pervade the involucra of the tongue, and affect its nervous pulp; and hence insoluble earths are quite insipid. Neither is it sufficient for a body to be soluble that it may be tasted: it must also have something in it saline, or at least acrid, in order to stimulate the nervous substance: and hence, whatever has less salt than the saliva is totally insipid.

The taste is rarely found to be too acute, unless through a fault in the epidermis which covers the tongue. If this be removed or wounded, or covered with ulcers, aphthæ, &c. then the taste, becoming too acute, is painful: or sometimes no other sensation than that of pain is felt. It may be impaired, as well as the sense of feeling, from various diseases of the brain and nerves; of which, however, the instances are but rare. In some people it is much more dull than in others; and in such the sense of smelling is usually deficient also. The taste is most commonly deficient on account of the want of saliva; for a dry tongue cannot perceive any taste: hence this sense is very dull in many diseases, especially in fevers, catarrhs, &c. as well on account of the defect of saliva as of appetite, which is of so much service in a state of health; or by reason of the tongue being covered with a viscid mucus.

The taste is frequently depraved; when, for example, we have a perception of taste without the application of any thing to the tongue: or, if any thing be applied to it, when we perceive a taste different from what it ought to be. This happens for the most part from a vitiated condition of the saliva, which is itself tasted in the mouth. Hence we may perceive a sweet, saline, bitter, putrid, or rancid taste, according to the state of the saliva: which may be corrupted either from the general vitiated condition of the mass of humours, or the glands which secret it; of the mouth itself; or even of the stomach, the vapours and eructations of which rise into the mouth, especially when the stomach is diseased.

Besides the faults of the saliva, however, the taste may be vitiated from other causes; as, for instance, the condition of the nervous papillæ. This, however, is as yet but little known to us; for the taste is sometimes plainly vitiated when at the same time the saliva appears quite insipid when tasted by other people.

Physicians, in almost every disease, but especially in fevers, inquire into the state of the tongue; not, indeed, without the greatest reason: for from this they can judge of the condition of the stomach; of the thirst, or rather the occasion the patient has for drink, when, on account of his delirium or stupor, he neither feels his thirst nor is able to call for drink. And, lastly, from an inspection of the tongue, physicians endeavour to form some judgement concerning the nature, increase, and remission of the fever.

79 Smell.

After the sense of taste, Dr Gregory next treats of that of smell. Its seat is in that very soft and delicate membrane, filled with nerves and blood-vessels, which covers the internal parts of the nose, and the various sinuses and cavities proceeding from thence. This sense is more acute about the middle of the septum, and the *ossa spongiosa*, where the membrane is thicker and softer, than in the deeper cavities, where the membrane is thinner, less nervous, and less filled with blood-vessels; although even these do not seem to be altogether destitute of the sense of smelling.

As by our taste we judge of the soluble parts of bodies, so by our smell we judge of those very volatile and subtile parts which fly off into the air; and like the organ of taste, that of smell is kept moist, that it may have the more exquisite sensation, partly by its proper mucus, and partly by the tears which descend from the eyes.

Some kinds of odours greatly affect the nervous sy-

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ſtem, and produce the moſt ſurpriſing effects. Some gratefully excite it, and immediately recruit the ſpirits when almoſt ſinking; while ſome produce fainting, nay, as it is alledged, even ſudden death. To this head alſo are we to refer thoſe antipathies, which, though truly ridiculous, are often not to be ſubdued by any force of mind.

This ſenſe is ſometime too acute, as well from ſome diſeaſe in the organ itſelf, which happens more rarely, as from the too great ſenſibility of the nervous ſyſtem in general, as is ſometimes obſerved in nervous fevers, phrenitis, and hyſteria. It is more frequently, however, too dull, either from diſeaſes of the brain and nerves, as from ſome violence done to the head, or from ſome internal cauſe; or it may proceed from a dryneſs of the organ itſelf, either on account of the cuſtomary humours being ſuppreſſed or turned another way, or from the membranes being oppreſſed with too great a quantity of mucus or of tears. Of both theſe caſes we have inſtances in the catarrh, where at firſt the noſtrils are dry, but afterwards are deluged with a thin humour, or ſtopped up with a thick one. But in theſe, and many other examples, the membrane of the noſe itſelf is affected with inflammation, relaxation, or too great tenſion, by which it is impoſſible but the nerves, which conſtitute a great part of it, muſt be vitiated. It is evident alſo, that whatever obſtructs the free entrance of the air into the noſtrils, or impedes its paſſage through them, muſt prove detrimental to the ſenſe of ſmelling.

80 Hearing.

The ſenſe of hearing is more frequently vitiated than almoſt any of the reſt, as having a moſt delicate organ, and one compoſed of many and very ſmall parts, of which an account is given under the article Anatomy.—It frequently becomes too acute; either from the general habit of the body being too irritable, ſuch as ſoon happens to hyſterical and lying-in-women; or from too great a ſenſibility of the brain itſelf, which is not unfrequently obſerved in fevers, as well as in phrenitis, and ſometimes in the true mania; or it may be from a diſeaſe of the ear itſelf, as when it is affected with inflammation, pain, or too great tenſion.—It may be rendered dull, or even be altogether deſtroyed, ſo that the perſon ſhall become totally deaf from the ſame cauſes acting with different degrees of force. This happens eſpecially from the want of the external ear; or from the meatus auditorius being ſtopped up with mucus, wax, or other matters; or from the ſides of the canal growing together, as ſometimes happens after ſuppuration or the ſmall-pox; or by the membrane of the tympanum becoming rigid or relaxed, or being eroded or ruptured; or the tympanum itſelf, or the Euſtachian tube, may from certain cauſes be obſtructed; or ſome of the little bones or membranes, or ſome of the muſcles of the labyrinth itſelf, may be affected with concretion, ſpaſm, palſy, or torpor; or laſtly, it may happen from diſeaſes from the brain and nerves, all the organs of hearing remaining ſound. Hence deafneſs is often a nervous diſeaſe, coming ſuddenly on, and going off of its own accord. Hence alſo it is common in old people, all of whoſe ſolid parts are too rigid, while their nervous parts have too little ſenſibility.

Perſons labouring under fevers, eſpecially of the typhous kind, often become deaf. When this comes on along with other ſigns of an oppreſſed brain, and a great proſtration of ſtrength, it may be a very bad ſign; but for the moſt part it is a very good one, even though accompanied with ſome degree of torpor or ſleepineſs.

A very common diſeaſe in the ſenſe of hearing is when certain ſounds, like thoſe of a drum, a bell, the falling of water, &c. are heard without any tremor in the air, or without a ſound perſon's hearing any thing. This diſeaſe is called *tinnitus aurium*, of which various kinds have been obſerved. For the moſt part it is a very ſlight tranſient diſorder; but ſometimes it is moſt obſtinate, long-continued, and troubleſome. It ſometimes ariſes from the ſlighteſt cauſe, ſuch as any thing partially ſtopping up the meatus auditorius or Euſtachian tube itſelf, ſo that acceſs is in part denied to the air; whence it happens that the latter ſtrikes the membrane of the tympanum, or perhaps the interior parts, unequally, and with too much force. Hence *bombi*, a kind of tinnitus, are heard even by the moſt healthy when they yawn.

A much more frequent and troubleſome ſpecies of tinnitus accompanies many diſeaſes both of the febrile and nervous kind. This is occaſioned partly by the increaſed impetus of the blood towards the head, with an increaſe of ſenſibility in the nervous ſyſtem itſelf, ſo that the very beatings of the arteries are heard; and partly from the increaſed ſenſation and mobility of the nerves and muſcles of the labyrinth; whence it happens, that the parts which ought to be at reſt until excited by the tremor of the air, begin to move of their own accord, and impart their motion to other parts which are already in a morbid ſtate of too great ſenſibility.

A tinnitus ſometimes ariſes from any vehement affection of the mind; ſometimes from a diſorder in the ſtomach; ſometimes from a rheumatic diſorder affecting the ears and head: or from a catarrh, which commonly affects the tube. Sometimes, however, the tinnitus alone affects the patient; and even this is a diſeaſe of no ſmall conſequence. Theſe various cauſes, however, both of this and other diſorders of the hearing, are often very difficult to be diſtinguiſhed, as well on account of the inacceſſible ſituation of the organ, as on account of the little knowledge we have of its action. But from whatever cauſe it ariſes, both this and the other various affections of the hearing can neither be cured certainly nor eaſily.

81 Sight.

Concerning the nature of the ſenſe of ſight, the reader may conſult the articles Anatomy and Optics. Of this ſenſe ſome ſlight diſorders, or rather varieties, are often obſerved. Thoſe perſons are called *ſhort-ſighted* who cannot ſee diſtinctly unleſs the object be very near them. This diſorder ariſes from too great a refraction of the rays by reaſon of their being too ſoon collected into a focus by the cryſtalline lens, and diverging again before they fall upon the retina, by which means they make an indiſtinct picture upon it. The moſt uſual cauſe is too great a convexity of the eye or ſome of its humours, as too prominent a cornea. Its a diſorder common to young people, which is ſometimes removed when they grow older. As ſoon as the firſt approaches of ſhort-ſightedneſs are obſerved, it is ſuppoſed it may be obviated by the perſon's accu-

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accustoming himself to view remote objects, and keeping his eyes off very small and near ones; as, on the contrary, it may be brought on by the opposite custom; because the eye accomodates itself somewhat to the distances of those objects which it is accustomed to view. But a concave glass, which causes the rays of light to diverge more than naturally they would before falling upon the cornea, is the most simple and certain remedy.

Long-sighted people are those who cannot see an object distinctly unless it be at a considerable distance from them. This arises from causes contrary to the former: namely, the eye being too flat, so that there is no room for refracting the rays and bringing them into a focus. Hence this defect is common in old people, and remedied by the use of convex glasses.

Those are called *nyctalopes* who see better with a very weak than with a strong light. It is a defect very seldom to be met with in the human race, though every person is sensible of it who hath been long kept in the dark and is then suddenly brought into the light. The disease arises from too great a sensibility of the retina, and the pupil being too open.

The sight is liable to many and grevous disorders. It is sharpened beyond measure, so that the person either perceives nothing distinctly, or with great pain, from the same causes that induce a similar disorder in the other senses; namely, excessive sensibility in the general habit of body; or a particular state of the brain common in phrenitis, or even in those afflicted with fevers arising from inflammation or too great excitement; though more frequently from the condition of the eye itself, one becomes unable to bear the light. The inflammation of the tunica adnata, and the forepart of the sclerotica, is communicated to the backparts of it, and from thence to the choroides and retina itself. Hence the light becomes intolerable, and vision is attended with pain and great irritation, sometimes inducing or augmenting a delirium.

The sense of seeing is made dull, or even totally abolished, by age; the aqueous humour not being supplied in sufficient quantity, and the cornea and lens, or the vitreous humour, becoming shrivelled or decayed. It may likewise happen from the cornea becoming dry and opaque; which is to be imputed to the languid motion of the blood, and to great numbers of the small vessels being obstructed or having their sides concreted;—or from the crystalline lens becoming yellow like amber, and the retina itself less sensible, for old age diminishes every sensation. It is totally abolished by injuries of the brain, the optic nerve, or the retina, even though the structure of the organ should remain sound. This disease is called an *amaurosis*; and is easily known by the dilatation and immobility of the pupil, the humours of the eye remaining clear. It is commonly owing to congestion of blood; and sometimes, where no congestion of blood can be shown, to mere torpor of the nerves. If it be only a torpor of part of the retina, we see black spots in those things at which we look; or flies seem to pass before our eyes, a very bad sign in fevers, and almost always mortal. The sight is abolished also by the obscurity or opacity of any of the parts through which the rays ought to pass and be refracted; as if the cornea lose its transparency by being covered with spots; or the aqueous humours become corrupted with blood, serum, or pus; or the lens (which often happens and which is called a *cataract*) becomes of a grey or brown colour, or the vitreous humour be in like manner corrupted; or lastly, when all the humours being dissolved, confused, and mixed together, by inflammation and suppuration, either do not suffer the light to pass at all, or to pass imperfectly and unequally; whence either no image is formed on the retina, or it appears obscure, distorted, imperfect, and ill-coloured.

The sight is also depraved, when things appear to it of a colour different from their own, or even in another situation and of another shape than they ought to have. This happens from the humours being tinctured with any unusual colour, as is said to happen in some instances of jaundice; or from an extravasation and mixture of the blood with the aqueous humour. A surprising depravation also, or constant and perpetual defect of vision, is not unfrequently observed in men otherwise very healthy, and who see quite clearly; namely, that they cannot distinguish certain colours, green, for example, from red*. Another depravation is, when, without any light being admitted to the eyes, sparks, small drops of a flame or gold colour, and various other colours, are observed to float before us. This is generally a very slight and transient disorder, common to those whose constitutions are very irritable; and arises from the slight impulse, as it would seem, on the retina, by the vessels beating more vehemently than usual. A fiery circle is observed by pressing the eye with the finger after the eye-lids are shut. The same reason, perhaps, may be given for those sparks which are seen by persons labouring under the falling-sickness, and increasing to the size of an immense and luminous beam before they fall down in convulsions. A similar beam those who have recovered from hanging or drowning testify that they have observed: for by reason of the respiration being suppressed, the vessels of the head swell and compress the whole brain and nervous parts of the head. Sparks of the same kind, and these too of no good omen, are observed in patients labouring under a fever, when a phrenitis or fierce delirium is at hand: and likewise in those who are threatened with palsy, apoplexy or epilepsy.—A distinct but false perception, namely of visible things which do not exist is to be imputed to some injury of the brain, to madness or a delirium, not to any disease of the eye.

* See the article COLOURS (*incapacity of distinguishing*).

A very frequent defect of vision remains to be mentioned; namely, squinting. A person is said to squint who has the axes of the eyes more oblique than usual, and directed to different points. Hence a great deformity, and often an imperfect and confused vision by which the objects are sometimes seen double. It is an evil for the most part born with the person, and often corrected by those attempts which an infant makes to see more pleasantly and distinctly; and this even without being conscious of its own effects. It is also easily learned, especially in infants, even without their own knowledge, by that kind of imitation which has a great influence over the human race, especially in their tender years.—It is by no means, however, so easily unlearned.

Squinting is frequently occasioned by a spasm, palsy, rigi-

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rigidity, &c. of the muscles which manage the eye; by epilepsy; by certain diseases of the head, the hydrocephalus especially; or by any great injury done to the head. Sometimes, though very rarely, it comes on suddenly without any known cause. It is very probable, however, that squinting often arises from a fault of the retinæ, when their central points, for instance, and those similarly placed with respect to the centre, do not agree. In this case there must be a contortion of the eye, that the object may not be seen double. This seems also to be the reason why squinting is horribly increased when the person brings the object near his eye in order to view it more perfectly. Or if the central point of either, or both, of the retinæ be insensible, or nearly so, it is necessary for the person to distort his eyes that he may have any distinct vision of objects. If the optic nerve had not entered the retina obliquely, but passed directly through its centre, we would all either have squinted or seen double.

82 Vertigo.

Physicians have referred to the sense of vision that most troublesome sensation which we call a *vertigo*: though it seems rather to belong to that of feeling, or of consciousness; for in many instances the disorder is not removed either in the dark or by shutting the eyelids. The vertigo takes place when external objects really at rest seem to reel, to whirl round, to tremble, or to move in any manner of way. If the disorder be very violent, the person is neither able to see, on account of a dimness of sight; nor can he stand, as the powers fail which ought to govern the limbs. A nausea also usually accompanies the vertigo, and the one generally produces the other.

This disorder is observed to be both the symptom and forerunner of some dangerous diseases; such as apoplexy, epilepsy, hysteria; hæmorrhages from the nose and other parts; suppressions of the menses; plethora; fevers, as well such as are accompanied with debility as those in which there is an increased impetus of the blood towards the head. An injury done to the head also, but rarely one done to the eyes, unless in so far as it affects the whole head, brings on a vertigo. A vertigo may be likewise produced by a very great and sudden loss of blood or other fluid; by debility; syncope; various diseases of the alimentary canal, of the stomach especially; poisons admitted into the body, particularly of the narcotic kind, as opium, wine, &c. and hence vertigo is a symptom of every kind of drunkenness. Various motions also, either of the head or the whole body, being tossed in a ship, especially if the vessel be small and the sea runs high, produce a vertigo. In these and similar examples, the unusual and inordinate motions of the blood are communicated to the nervous parts which are in the head; or these being affected by sympathy from the neighbouring parts, produce a confused sensation as if of a rotatory motion. Nay, it is often produced from an affection of the mind itself, as from beholding any thing turned swiftly round, or a great cataract, or looking down a precipice, or even by intense thought without looking at any thing.

Though a vertigo be for the most part a symptom and concomitant of other diseases, yet it is sometimes a primary disease, returning at intervals, increasing gradually, and equally impeding and destroying the functions of the body and mind.

Internal Senses.

83 Memory.

After having treated of the external senses, doctor Gregory next proceeds to consider those properly called *internal*; which are, the *memory*, the *imagination*, and the *judgment*. The first is lessened, disturbed, or even totally destroyed, in many diseases, especially those which affect the brain; as the apoplexy, palsy, internal tumors of the head, external violence applied, fevers, especially those in which there is an increased motion of the blood towards the head, or where the brain is any other way much affected. It is very rarely, however, depraved in such a manner that ideas are not represented to the mind in their proper order; or if at any time such a disorder occurs, it is considered rather as a disorder of the imagination, or as a delirium, than a failure of the memory. The mind is said to be disordered when the perceptions of memory or imagination are confounded with those of sense, and of consequence those things believed to be now present which are really past or which never existed; or when the sense of the person concerning ordinary things is different from that of other people. The general name for such disorders is *vesania*: if from fever, it is called *delirium*. A general fury without a fever, is called *mania*, or *madness*: but a partial madness, on one or two points, the judgment remaining sound in all other respects, is called *melancholia*. There is, however, no exact and accurate limits between a sound mind and madness. All immoderate vivacity borders upon madness; and, on the other hand, a sorrowful and gloomy disposition approaches to melancholy.

85 Delirium.

Delirium accompanies fevers of many different kinds. Sometimes it is slight, easily removed, and scarce to be accounted a bad sign. Often, however, it is very violent, and one of the very worst of signs, requiring the utmost care and attention.

A delirium is either fierce or mild. The fierce delirium is preceded and accompanied by a redness of the countenance, a pain of the head, a great beating of the arteries, and noise in the ears; the eyes in the mean time looking red, inflamed, fierce, shining, and unable to bear the light; there is either no sleep at all, or sleep troubled with horrid dreams; the wonted manners are changed; an unusual peevishness and ill-nature prevail. The depravation of judgment is first observed between sleep and waking, and by the person's crediting his imagination, while the perceptions of sense are neglected, and the ideas of memory occur in an irregular manner. Fury at last takes place, and sometimes an unusual and incredible degree of bodily strength, so that several people can scarce keep a single patient in his bed.

The mild delirium, on the contrary, is often accompanied with a weak pulse, a pale collapsed countenance, and a vertigo when the patient sits in an erect posture; he is seldom angry, but often stupid, and sometimes remarkably grieved and fearful. The loss of judgment, as in the former kind, is first perceived when the patient is half awake; but a temporary recovery ensues upon the admission of the light and the conversation of his friends. The patient mutters much to himself, and attends little to the things around him; at last, becoming quite stupid, he neither feels the

Delirium. sensations of hunger or thirst, nor any of the other propensities of nature, by which means the urine and excrements are voided involuntarily. As the disorder increases, it terminates in subsultus tendinum, tremors, convulsions, fainting, and death. The other species of delirium also frequently terminates in this, when the spirits and strength of the patient begin to fail.

The symptoms accompanying either of these kinds of delirium show an unusual, inordinate, and unequal motion of the blood through the brain, and a great change in that state of it which is necessary to the exercise of the mental powers. It is sufficiently probable, that an inflammation of the brain, more or less violent and general, sometimes takes place, although the signs of universal inflammation are frequently slight. This we learn from the dissection of dead bodies, which often show an universal redness of the brain or of some of its parts, or sometimes an effusion or suppuration.

The state of the brain, however, may be much affected, and a delirium induced, by many other causes besides the motion of the blood. In many fevers, typhus, for instance, the nervous system itself is much sooner and more affected than the blood; and though the morbid affections of the nervous system are as invisible to the senses as the healthy state of it, the symptoms of its injuries plainly show that its action, or *excitement* as some call it, is unequal and inordinate. In this way, too, a delirium is produced by several poisons.

85 Melancholy and mania. The pathology of melancholy and mania is much more obscure; as coming on without a fever, or disturbance in the blood's motion. Often also they are hereditary, depending on the original structure of the body, especially of the brain; the fault of which, however, cannot be detected by the nicest anatomist. But it is well known, that various diseases of the brain, obstructions, tumours, either of the brain itself, or of the cranium pressing upon it, any injury done to the head, and, as some physicians relate, the hardness and dryness of the brain, and some peculiar irritations affecting the nervous system, are capable of bringing on this malady. And indeed so great are the irritations affecting the nervous system in mad people, that they often sleep little or none for a long time.—yet even this so defective and imperfect knowledge of the diseases of the brain and nerves, is by no means free from difficulties. For though we know that the brain, or a certain part of it, is hurt, or that it is irritated by a swelling, or a pointed bone growing into it, nobody can foretel how great, or what may be the nature of the malady from such a hurt: for examples are not wanting of people who, after losing a large part of the brain, have recovered and lived a long time; or of those who have perceived no inconvenience from a large portion of that viscus being corrupted, until at length they have fallen suddenly down and died in convulsions.

86 Idiotism. Another disease of the internal senses, quite different from these, is *fatuity* or *idiotism*. Those are called *idiots* who are destitute either of judgment or memory, or else have these faculties unequal to the common offices of life. A kind of idiotism is natural and common to all infants; neither is it to be accounted a disease: but if it lasts beyond the state of infancy, it is a real disease, and for the most part incurable. It has the same causes with the other diseases of the internal senses; although these can scarcely be detected by the eye or by the knife of the anatomist. It frequently accompanies, or is the effect of, epilepsy. Hence, if the epilepsy derives its origin from causes not seated in the head, as from worms lodging in the intestines, the fatuity may be cured by dislodging these, and removing the epilepsy. It is not unlikely that the fatuity of children, and the dotage of old men, may arise from the brain being in the former too soft and in the latter too hard. Idiotism.

87 Disorders in the muscular power. The muscular power may be diseased in a great number of ways. The mobility itself may be too great; but this must be carefully distinguished from vigour. By mobility is meant the ease with which the muscular fibres are excited into contraction. The vigour, on the other hand, is that power with which the contraction is performed. They are sometimes joined, but more frequently separate, and for the most part the excesses of each are owing to contrary causes.

88 Mobility. Too great mobility is when motions are excited by too slight a stimulus, or when too violent motions are produced by the customary stimulus. A certain habit of body, sometimes hereditary, renders people liable to this disease. Women have a greater share of mobility than men have. Infants have a great deal of mobility, often too great; youth has less than infancy, but more than man's estate; though old age has commonly too little. A lazy, sedentary life, full diet, a suppression of the usual evacuations, fulness of the blood-vessels, and sometimes their being suddenly emptied, laxity, flaccidity of the solids in general, but sometimes too great a tension of the moving fibres, the use of diluents, especially when warm, or heat applied in any manner, produce too great mobility. And this may be either general or particular, according as the causes have been applied to the whole body or only to a part of it.

89 Vigour. Vigour in general is rarely morbid; although sometimes certain muscular parts appear to have too great strength. In maniacs and phrenitics, an immense strength is observed in all the muscles, especially in those that serve for voluntary motion; which is not unjustly reckoned morbid. The reason of this excess is very obscure; however, it is plainly to be referred to a diseased state of the brain.

A more frequent and more important excess of vigour is observed in those muscular fibres that do not obey the will, such as those which move the blood. Its circulation is thus often increased, not without great inconvenience and danger to the patient. But a slighter excess of this kind, pervading the whole body, renders people apt to receive inflammatory diseases, and is usually called a *phlogistic diathesis*. But this is better observed when local, as in inflammation itself.

Too great vigour of the muscular fibres may arise from the nervous power increased beyond measure, as in mania, phrenitis, or violent affections of the mind; from too great a tension of the fibres, by which they more easily and vehemently conceive motions, as of the arteries when filled with too much blood; from catching cold, by being exposed either to cold or heat, as usually happens in the spring; or lastly, though the nervous power and tension of the fibres should

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should not at all be changed, their action may become too great, from a stimulus more violent than usual being applied, or from the usual stimulus if the fibres themselves have already acquired too great a share of mobility.

90 Torpor.

The opposite to too great mobility is torpor, and to too great vigour is debility. Torpor is such a diminution of mobility as renders the parts unequal to their functions. It arises from causes directly opposite to mobility; such as, in the first place, a harder and more rigid contexture of the parts themselves, or even sometimes from one too lax and flaccid; from old age; from some peculiar temperament of body, such as one phlegmatic, frigid, or insensible; too great and incessant labour, cold, spare diet, and an exhausted body. This evil is the more to be dreaded, because, the powers of the body being deficient, nature is neither able to make any effort of herself, nor are the remedies, in other cases the most efficacious, capable of affording her any assistance.

91 Debility.

Debility takes place, when the motion of the muscles, either voluntary or involuntary, is not performed with sufficient strength. A greater or lesser share of debility, either general or of some particular part, accompanies almost all diseases, and is indeed no small part of them: for it is hardly possible that a disease can subsist for any length of time without inducing some degree of debility. When a state of debility is induced, it renders a man obnoxious to innumerable disorders, and throws him as it were defenceless in their way. It often depends on the original structure of the body, so that it can be corrected neither by regimen nor medicines of any kind. A different degree of strength also accompanies the different ages of mankind; and thus, in some cases, debility cannot be reckoned morbid. But a truly morbid and unwonted debility arises from the nervous force being diminished; from diseases of the brain and nerves, or of the muscles through which they are distributed; from a decay of the nerves themselves; from a want of the due tension of the fibres, or the fibres themselves becoming torpid; from the body exhausted by spare diet, want, evacuations; or lastly, from diseases affecting the whole body, or some particular parts of it.

92 Palsy.

The highest degree of debility, namely, when the strength of the muscles is altogether or nearly destroyed, is called *paralysis* or *palsy*; and is either universal, or belonging only to some particular muscles. An universal palsy arises from diseases of the brain and nerves, sometimes very obscure, and not to be discovered by the anatomist; for the nervous power itself is often deficient, even when the structure of the nerves remains unhurt: yet often a compression, obstruction, or injury of the vessels, extravasation of blood, or serum, collections of pus, swellings, &c. are discovered. It frequently arises from certain poisons acting on the nerves; from the fumes of metals; from the diseases of parts, and affections of the muscles, very remote from the brain, as in the colic of Poictou. A palsy of single muscles, but less perfect, often arises without any defect of the brain or nerves, from any violent and continued pain, inflammation, too great tension, relaxation, rest, or destruction of the contexture of the parts, such as commonly happens after the rheumatism, gout, luxations, fractures of the bones, and ischuria.

An *universal* palsy, however, as it is called, seldom affects the whole body, even though it should originate from a disease of the brain. We most commonly see those who are paralytic affected only on one side, which is called an *hemiphlegia*. It is said that the side of the body opposite to the diseased side of the brain is most commonly affected. If all the parts below the head become paralytic, it is called a *paraplegia*. In these diseases the senses for the most part remain; though sometimes they are abolished, and at others rendered dull. Sometimes, though rarely, and which is an exceeding bad sypmtom, the motion, sensation, pulse, and heat of the paralytic limbs are lost; in which case the arteries themselves become paralytic. A palsy of the whole body, as far as regards the voluntary motions, with anæsthesia and sleep, is called an *apoplexy*. This proceeds from some injury of the brain: though a state very similar to it is induced by narcotics, opium, wine itself, or any generous liquor taken to excess; and lastly, by breathing in air corrupted by noxious impregnations, such as a large proportion of carbonic acid, hydrogenous, gas, or any similar active aeriform fluid.

93 Spasm.

Another disease to which muscular motion is liable, and that neither slight nor unfrequent, is called *spasm*. This is a violent and irregular motion of the muscles. Of spasms there are two kinds, the tonic and clonic. The latter is frequently called a *convulsion*; in order to distinguish it from the other, which is more peculiarly called *spasm*.

Spasm therefore is a violent, constant, and preternatural contraction of the muscular fibres; but a convulsion is an unusual and violent contraction alternated with relaxation. People are rendered liable to spasm by too sensible an habit of body, or too great mobility; and hence it is a disease common in women, in infants, and in weak, luxurious, lazy, and plethoric people. It is brought on those already predisposed to it, by any kind of stimulus applied to the brain, or to any nerve, muscle, or nervous part connected with it: of which we have examples in dentition; worms lodged in the intestines, and irritating them; any acrid matter infecting the blood, or much affecting the stomach and intestines; the irritation of any nerve, or of the brain itself, by an exostosis, swelling, too great fulness of the vessels, pain, vehement affections of the mind, sudden evacuation, or poisons admitted into the body. Frequently, however, the malady originates from slight causes, little known, and not easily observed.

Spasm is both the cause and effect, and frequently constitutes the greatest part, of most diseases. It is often very difficult either to be known or cured; because it is so multiform, and produces as many different symptoms as there are organs affected; of which it surprisingly disturbs, impedes, or increases the functions. It is a disease seated in the original stamina of the constitution; and neither to be removed by slight remedies, nor in a short time.

94 Sleep.

With regard to sleep, Dr Gregory observes, that its use is sufficiently apparent from the effects which it produces in the body. It restores the powers both of mind and body when exhausted by exercise, giving vigour to the one, and restoring its wonted alacrity to the

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the other. It renders the muscles again active and moveable, after they have become wearied, rigid, painful, and trembling by hard labour. It moderates the quickness of the pulse, which usually increases at night, and brings it back to its morning standard. It seems also to assist the digestion of the aliment; lessens both the secretions and excretions; and renders the fluids thicker than otherwise they would be, especially in a body endowed with little sensibility or mobility. Hence sleep is not only useful, but absolutely necessary for preserving life and health; and is a most excellent remedy both for alleviating, and totally removing, a great many diseases.

Want of sleep is hurtful in a great many different ways, especially to the nervous system. It renders the organs of sense both external and internal, as well as those of every kind of motion, unfit for performing their offices. Hence the sensations are either abolished, or become imperfect or depraved; and hence imbecility of mind, defect of memory, a kind of delirium, mania itself, pain of the head, weakness of the joints, an imperfect or inordinate action of the vital organs, quickness of pulse, heat, fever, depraved digestion, atrophy, leanness, and an increase or perturbation of the secretions and excretions.

Sleep may be prevented both in healthy and sick people from various causes; such as strong light, noise, pain, anger, joy, grief, fear, anxiety, hunger, thirst, vehement desire, motion of the body, memory, imagination, intense thought, &c. On the other hand, sleep is brought on by a slight impression on the organs of sense, or none at all; by the humming of bees, the noise of falling water, cold and insipid discourse; or lastly, by such an exercise of the memory as is neither too laborious nor disturbing to the mind.—Too great an impulse of the blood towards the head, such as often happens in fevers, prevents sleep; but a free and equal distribution of the blood through the whole body, especially the extreme parts, frequently brings it on. Whatever weakens the body also favours sleep; and hence various kinds of evacuations, the warm bath, fomentations, sometimes heat itself, are useful for promoting it. It also comes on easily after taking food, or indulging venery, the violent sensation being then quieted, and the body itself somewhat weakened. Cold produces a deep sleep of long continuance, not easily disturbed, and often terminating in death. Lastly, there are certain substances which, when applied to the body, not only do not excite the nervous system, but plainly lay us asleep, and render us unfit for sensation: of this kind are those called *narcotics*, as opium and the like; among which also we may reckon wine taken in too great quantity. Lastly, watching itself is often the cause of sleep; because while a man is awake he always more or less exercises the organs of his body, by which the nervous influence is diminished, and thus the more violently the body is exercised, in the same proportion is the person under a necessity of sleeping.

Sleep is deficient in many diseases; for there are few which do not excite pain, anxiety, or uneasiness, sufficient to prevent the approach of sleep, or to disturb it. Fevers generally cause those who labour under them to sleep ill; as well on account of the uneasiness which accompanies this kind of diseases, as by reason of the impetus of the blood towards the head being frequently increased; and likewise from the stomach being disordered, loaded with meat, or distended with drink. Hence also we may see the reason why many hypochondriac and hysteric patients sleep so ill: because they have a bad digestion, and their stomach is disposed to receive many though frequently slight disorders; the slightest of which, however, is sufficient to deprive the patient of rest, provided the body be already irritable, and endowed with too great a share of mobility.

Want of sleep will hurt in diseases as well as in health; and for the same reason; but in a greater degree, and more quickly, in the former than in the latter; and is therefore not only a very troublesome symptom of itself, but often produces other very dangerous ones.

Too much sleep, on the other hand, produces many mischiefs, rendering the whole body weak, torpid, and lazy; and it even almost takes away the judgment. It also disturbs the circulation, and diminishes most of the secretions and excretions. Hence plethora, fatness, flaccidity, and an inability for the common offices of life.—The causes of this excess are, either the usual causes of sleep abovementioned increased beyond measure, or some fault in the brain, or a compression of it by an extravasation of the humours; or sometimes, as it would seem, from great debility produced by an unusual cause, as in those who are recovering from typhous fevers and other diseases. In those examples, however, this excess of sleep is by no means hurtful; nor even, perhaps, in these cases where an excess of grief continued for a long time, or a great fright, have produced a surprising and unexpected somnolency. Lastly, many people have accustomed themselves, and that not without a great deal of hurt to their constitutions, to sleep too much. Nor are there examples wanting of some who have passed whole days, and even months, in sleep almost uninterrupted.

95 Circulation.

With regard to the manner in which the circulation of the blood is performed, and the various principles of which it is composed, see the articles Blood, and Anatomy. As for the disorders to which the blood and its circulation are subject, Dr Gregory observes, that in our younger years the veins are much more dense, firm, and strong, than the arteries; but the latter, by reason of the continual pressure upon them, and the strength which they exert, become daily more firm, hard, and strong, until at last they equal or exceed the veins themselves in strength; and it is not uncommon in old men to find some part of the arteries converted into an horny substance, or even into a solid bone. Hence in the state of infancy the greatest part of the blood is contained in the arteries, and in old age in the veins; an affair indeed of no small moment, as it shows the reason in some measure of the state of increase and decrease of the body. Besides, if any disease happens from too great a quantity of blood, it thence appears that it must show itself in young subjects in the arteries, and in old ones in the veins; and this is the reason of many diseases which accompany certain periods of life.

In most, if not in all species of animals, the arteries of the females are much more lax and capacious when compared with the veins, and the veins much less, than in

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in the males of the ſame genus. The deſign of nature in this conformation, is probably that they may be the better able to nouriſh the fœtus in their womb. The ſame likewiſe ſeems to be the reaſon why women are more inclined to plethora than men; and to this greater capacity of the arteries and ſmallneſs of the veins are we to aſcribe that beauty and elegant ſhape of the arms in women, not disfigured or livid with veins as in men.

The blood is alſo diſtributed in various proportions to the different parts of the body, and that proportion too differs at different periods of our lives. At firſt an immenſe quantity is ſent to the head, becauſe that part of the body is firſt to be evolved and fitted for its offices: but as ſoon as the parts begin to make a conſiderable reſiſtance to the efforts of the blood, and the veſſels cannot eaſily be further dilated, it is neceſſarily ſent off to other parts; by which means the reſt of the body increaſes in bulk, and becomes fitted for performing its proper functions. The effect of this change is alſo very ſoon obſerved, namely, when none of the blood paſſes through the navel, and of conſequence a greater quantity is ſent by the iliac arteries to the inferior extremities. Theſe, though ſo ſmall and ſlender in the fœtus, increaſe very ſuddenly; ſo that often in not many months the child can not only ſtand on its feet. but even walk tolerably well.

96 Pulſation of the arteries.

Phyſicians are wont to judge of the ſtate of the circulation by the pulſe; which indeed is very various, as well with regard to its frequency, as to the ſtrength and equality of its ſtrokes and intervals.—Its common quickneſs in a healthy grown-up perſon is about 70 ſtrokes in a minute. In a fœtus, perhaps, it is more than double; and in an infant a few months old, hardly leſs than 120. As we grow up, this quickneſs gradually diminiſhes; ſo that in extreme old age it ſometimes does not exceed 50, or is even ſlower. This rule, however, is not without exceptions: for many, eſpecially thoſe of an irritable habit, have the pulſe much quicker; while others, even in the vigour of their age, have the pulſe remarkably ſlow. It is for the moſt part ſomewhat quicker in women than in men.

The pulſe is alſo rendered quicker, both in a healthy and diſeaſed body, by the application of ſtimuli of many different kinds. Exerciſe eſpecially, by accelerating the return of the blood through the veins, increaſes the quickneſs of the pulſe to a ſurpriſing degree. Various kinds of irritations affecting the nervous ſyſtem, as intenſe thinking, paſſions of the mind, pain, heat, ſtimulating medicines, wine, ſpices, &c. likewiſe produce the ſame effect. The acrimony of the blood itſelf alſo is thought to quicken the pulſe.

When a perſon firſt awakes in the morning, the pulſe is ſlow, but becomes quicker by degrees on account of the many irritating matters applied to the body. Its quickneſs is increaſed after taking food, eſpecially of the animal kind, or ſuch as is hot or ſeaſoned with ſpices. In the evening a ſlight fever comes on, for which reſt and ſleep are the remedy. Theſe things, however, are ſcarce to be obſerved in a healthy perſon, but are very evident in one that is feveriſh, eſpecially when the diſeaſe is a hectic.—Again, even debility itſelf often renders the pulſe quicker than uſual; becauſe the ventricle of the heart not being quite emptied, it is the ſooner dilated again, and of conſequence contracts the ſooner. For this reaſon a phyſician can never judge of the ſtrength of the circulation from the frequency of the pulſe.

Laſtly, in all fevers, however different from one another, the pulſe is found to be too quick, partly perhaps from debility, partly from the acrimony of the fluids, and partly from the repulſion of the blood from the ſurface of the body, and the accumulation of it in the large veſſels where it acts as a ſtimulus; though it muſt be owned, that a great deal of this is obſcure, if not totally unknown; nor in truth are we able to underſtand in what manner the *autocrateia* acts with regard to the frequency of the pulſe.

The pulſe is ſeldom obſerved too ſlow, unleſs when the mobility of the body is much diminiſhed, as in decrepid old age, or from a compreſſion or diſeaſe of the brain; but a greater compreſſion of the brain uſually produces a ſtill more remarkable ſlowneſs of the pulſe, as in the hydrocephalus, apoplexy, &c.—Sometimes alſo the pulſe is too ſlow in thoſe who are recovering from tedious fevers. But this is a matter of little moment, and ſeems to be owing to ſome kind of torpor. Indeed it has generally been conſidered as a mark of a thorough and complete ſolution of the fever; for it is commonly obſerved, that when this ſtate of the pulſe takes place, the patient ſeldom ſuffers a relapſe.

While the frequency of the pulſe continues the ſame, its ſtrokes may be either full, great, ſtrong, and hard; or ſoft, ſmall, and weak. A full, great, and ſtrong pulſe takes place when the ventricle ſtrongly and completely empties itſelf; throwing out a greater quantity of blood into the arteries, which fully diſtends them and ſtimulates them to a ſtrong contraction. A pulſe of this kind is common in ſtrong healthy men, and is ſeldom to be accounted a ſymptom of diſeaſe. But if it be too ſtrong, and ſtrike the finger of the perſon who feels it violently and ſharply, it is called a *hard pulſe*. This hardneſs is produced by a ſudden and violent contraction of the heart and arteries, which diſtends even the remote branches, as thoſe of the wriſt, too ſuddenly and ſmartly, and excites them alſo to ſudden and violent contractions.

A hard pulſe therefore denotes too great an action of the heart and arteries. It may ariſe from various cauſes: in the firſt place, from too great a tenſion of the veſſels; for inſtance, from their being too full, and by that means more prone to motion, and the more fit for receiving violent motions. It may ariſe alſo from too great a denſity and firmneſs of the ſolids; and hence it is moſt frequent in cold countries, among ſtrong robuſt people, and ſuch as are accuſtomed to hard labour. It may likewiſe ariſe from various cauſes irritating the whole nervous ſyſtem, or only the heart and arteries. Laſtly, it accompanies many fevers, as well as moſt inflammatory diſorders, whether the inflammation ariſes from a general ſtimulus applied to the whole body, or from the irritation of particular parts, by degrees extended over the whole body. In ſuch a ſtate of the circulation, the patient frequently ſtands in need of blood-letting, and almoſt always bears it well.

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A ſmall, weak, and ſoft pulſe is generally owing to cauſes oppoſite to the foregoing, and indicates a contrary ſtate of the circulation and nervous ſyſtem. It frequently requires ſtimulants; nor does it generally require blood-letting, or eaſily bear it. Sometimes, however, a pulſe of this kind is obſerved even in the caſe of a dangerous inflammation, of the ſtomach for inſtance, or inteſtines. But in theſe and the like examples, we ought to attend to the nature of the malady, much more than to the ſtate of the pulſe.

The pulſe is ſaid to intermit, when the ſtroke does not return after the uſual interval, and perhaps not till after twice, thrice, or four times the uſual ſpace. A pulſe of this kind ſeems to be almoſt natural and conſtant in ſome animals, and is common to ſome men even in the moſt perfect health; and if theſe happen to be ſeized with a fever, the pulſe ſometimes becomes equal, nor can the diſeaſe be removed before the intermiſſion has returned.

Moreover, in ſome people, though their pulſe beats equally while in health, yet the ſlighteſt illneſs makes it intermit; and in others, eſpecially thoſe who have a great deal of mobility in their conſtitution, ſuch as hypochrondriac and hyſteric people, the intermiſſion of the pulſe is felt, without applying the finger to the artery, merely by the uneaſineſs which they perceive in their breaſts during thoſe intervals in which the pulſe is deficient. An intermittent pulſe likewiſe occurs in many diſeaſes of the breaſt, eſpecially when water is collected in it; and the like happens in the end of all diſeaſes, eſpecially fevers, when the ſtrength is nearly exhauſted, and death approaches, of which it is frequently the forerunner.

An intermitting pulſe therefore ſeems to ariſe from an unequal influx of the nervous power into the heart, or from the decay and exhauſtion of the nervous power, by which means the heart is not able to contract till it has been diſtended beyond its due pitch. Or laſtly, it may ariſe from diſeaſes of the organ itſelf, or the neighbouring parts; from ſwellings, water, &c. preſſing upon them, and impeding the action of the heart: which indeed is a very dangerous diſorder, and almoſt always mortal.

Many other variations of the pulſe are enumerated by phyſicians, but moſt of them uncertain, and not confirmed by experience. We ſhall therefore now conſider the motion of the blood, which may be either too great, too ſmall, or irregular.

A quick pulſe, *cæteris paribus*, produces a more rapid circulation, becauſe the ſooner that the ventricle of the heart is emptied, the more quickly is the blood thrown into the arteries; and their actions muſt anſwer to this ſtronger ſtimulus. Hence exerciſe, heat, ſtimulants, plethora, every kind of irritation, paſſions of the mind, and fever, increaſe the circulation. The effect of this increaſe is a diſtenſion of the veſſels, a ſtimulus applied to the whole body, an increaſe of heat, and often a debility. The ſecretion of ſweat is increaſed while the other ſecretions are diminiſhed, and the various functions of the body impeded; thirſt comes on, the appetite is loſt, the fat conſumed, and a diſpoſition to putreſcency introduced. Sometimes the ſmaller veſſels are burſt; whence effuſions of blood and hæmorrhages. But we are by no means to forget, that this violent motion of the blood, however hurtful it may ſeem, is among the beſt remedies made uſe of by nature in curing many diſeaſes.

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The motion of the blood is diminiſhed, eſpecially by debility, torpor, the want of irritation or of exerciſe: the ſame thing happens to all the humours, if there be any obſtruction in the veſſels, or any cauſe by which their return is hindered or rendered more difficult. Thus, from the very weight of the blood itſelf, if a perſon has ſtood long on his feet, the humours return more ſlowly from the inferior extremities. Any diſeaſe of the heart and arteries alſo, as an aneuriſm, contraction, oſſification, muſt neceſſarily obſtruct the circulation. The ſame thing happens from obſtructions of the veins, or interrupted inſpiration, by which the paſſage of the blood through the lungs to the left ſide of the heart is impeded.

But, from whatever cauſes this diminution of the circulation takes place, the bad conſequences are perceived chiefly in the veins, becauſe in them the blood always moves more ſlowly than in the arteries. Hence varices, and congeſtions of blood, eſpecially in thoſe parts of the body where the veins are deſtitute of valves, and of conſequence where the motion of the muſcles cannot aſſiſt the circulation. Hence alſo ariſe dropſies from an impeded or languid motion of the blood; becauſe the reſiſtance of the veins being increaſed, the blood is received into them with the greater difficulty, and more of the thin humour is driven into the exhaling veſſels, and by them depoſited in ſuch quantities as cannot be reabſorbed by the lymphatics. Theſe diſeaſes, as well as all others proceeding from defects of the circulation, are alſo more difficult of cure than others, becauſe all the vital powers are weakened at the ſame time.

Another diſorder of the circulation is where the blood is carried to one part of the body in too great quantity, by which means the other parts are deprived of their due proportion. This irregular diſtribution of the vital fluid frequently ariſes from a ſtimulus applied to the part itſelf, or to the brain, or at length acting on the mind, which, according to the laws of ſympathy, produces a certain and definite diſtribution of the blood. It ariſes alſo not unfrequently from a ſpaſm taking place in ſome other parts, which drives the blood out of its ordinary courſe.

In proportion to this irregularity of the circulation are the conſequences; heat, ſwelling, redneſs, inflammation, ruptures of veſſels, hæmorrhages, effuſions, deſtruction, corruption, and ſuppuration of the cellular texture and adjoining parts, &c. Even this evil, however, nature often converts into an excellent remedy; and phyſicians, following her ſteps, frequently attempt to direct the diſtribution of the blood in particular diſeaſes, well knowing that a change in the diſtribution in the blood is frequently efficacious either for radically curing ſome diſeaſes or relieving their moſt urgent ſymptoms.

97 Palpitation.

Laſtly, ſome diſorders in the motion of the heart itſelf, and thoſe of no ſmall conſequence, remain yet to be taken notice of, namely, palpitation and ſyncope. A palpitation is a violent and irregular action of the heart, ſuch as for the moſt part is perceived by the patient himſelf, and that not without a great deal of uneaſineſs and oppreſſion at his breaſt; and is alſo manifeſt to the by-ſtanders if they apply their hands, or

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look at his naked breaſt; the pulſe of the arteries in the mean time being weak, unequal, and intermitting. This is a ſpaſmodic diſorder; and is induced by various cauſes affecting either the nervous ſyſtem in general, or the heart in particular. Every diſeaſe of the organ itſelf, ſuch as a conſtriction of its valves and blood-veſſels, and oſſification, enlargement, or polypus, hindering the free action of the heart, and evacuation of blood from it, are capable of exciting it to violent and unuſual contractions. The ſame effect will alſo follow plethora, or too violent an impulſe of the blood, &c. The heart will likewiſe frequently palpitate from a violent excitement of the nervous ſyſtem, eſpecially where the conſtitution is endowed with a great deal of mobility. Hence palpitations from any affection of the mind, and in hyſteric women. Palpitation may likewiſe ariſe from an affection of the ſtomach, occaſioned by worms, a ſurfeit, flatus, or ſtimulation by various acrid ſubſtances. It frequently alſo accompanies the gout when driven back, or even when a fit is coming on. Sometimes it ariſes from debility, whatever may be the cauſe; frequently from any difficulty in breathing; and many of theſe cauſes may be joined at the ſame time, or ſome of them produce others.

Hence we may ſee why the evil is ſometimes ſlight and of ſhort continuance; at other times altogether incurable, and certainly mortal in a long or ſhorter time; why it ſometimes returns at intervals, often coming on and being increaſed by every kind of irritation and exerciſe, and ſometimes relieved or totally removed by ſtimulants or exerciſe.

98 Syncope.

A ſyncope is when the action of the heart, and, along with it, that of the arteries, is ſuddenly and very much leſſened; whence the animal-powers, the ſenſes, and voluntary motions, immediately ceaſe. This may be produced by almoſt all the cauſes of palpitation; becauſe whatever can diſturb and diſorder the motion of the heart, may alſo weaken or ſuſpend it. The vitiated ſtructure of the heart itſelf therefore, violent paſſions of the mind, whether of the depreſſing kind, or thoſe which ſuddenly and vehemently excite, various kinds of nervous diſeaſes, thoſe of the ſtomach, every kind of debility and evacuation, eſpecially a great loſs of blood, exceſſive and unremitting labour, long watching, heat, pain, many kinds of poiſons, &c. produce fainting.

Hence we ſee, that whatever weakens the motion of the blood through the brain tends to produce fainting; and, on the contrary, whatever tends to augment that motion, alſo tends to refreſh, and prevent the perſon from fainting. Hence alſo we ſee how the mere poſture of the body may either bring on or keep off fainting, or remove it after it has already come on. We likewiſe ſee how this diſorder may ſometimes be of little conſequence and eaſily removed; at others very dangerous, not only as a ſymptom, but in even itſelf, as ſometimes terminating in death; and laſtly, how it may be uſed as a remedy by a ſkilful phyſician, and artificially induced, either to free the patient from violent pain, or to ſtop an immoderate effuſion of blood ſcarce to be reſtrained by any other method.

99 Buff coloured crust on the blood.

With regard to the diſorders of the blood itſelf, Dr Gregory obſerves, that the glutinous part of it produces that buff-coloured appearance often ſeen upon blood drawn from people afflicted with inflammatory diſorders, and even ſometimes when no ſuch diſeaſes are preſent. This cruſt indeed is nothing elſe than the pure gluten of the blood taking longer time than uſual to coagulate, by which means the red particles have an opportunity of falling to the bottom. This indicates no lentor, denſity, thickneſs, or tenacity of the blood, as was formerly thought; but rather its thinneſs, or at leaſt a leſs tendency in it to coagulate. It ariſes for the moſt part from a violent agitation and conquaſſation of the blood within the body: and hence it accompanies many fevers, all inflammations, ſometimes hæmorrhages, exanthemata, plethora, pain, and many irritations. It muſt however be allowed, that in ſeveral of theſe diſeaſes it is rendered highly probable, at leaſt from experiments apparently accurate, that the quantity of the gluten of the blood is really encreaſed in the proportion which it bears to the other parts. This cruſt, however, is not always to be accounted morbid, as it often happens to the moſt healthy; and may even be produced or deſtroyed by the ſlighteſt cauſes while the blood is running from the vein, ſo that frequently we ſhall ſee a very thick and tenacious cruſt on the blood flowing into one cup, while that which runs into another has little or none at all. In general, however, the appearance of this cruſt ſhows, that the patient will bear blood-letting well, though thoſe have been in a great miſtake who directed this operation to be repeated till no more cruſt appeared on the blood.

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The glutinous part of the blood alſo frequently produces thoſe maſſes called *polypi*, which ſometimes take place during life, but more frequently after death, in the large veſſels near the heart, or even in the cavities of that organ. Similar maſſes alſo are frequently formed in the uterus, and are called *moles*.

100 Plethora.

The quantity of blood contained in a healthy body is very various, and difficult to be aſcertained. Many diſeaſes, however, may ariſe from its being either too ſcanty or too abundant. Too great a quantity of blood is produced by the uſe of rich nouriſhing diet, ſtrong drink, accompanied with a good digeſtion; from a lazy, ſedentary life, or much ſleep, eſpecially in thoſe who have been formerly accuſtomed to much exerciſe; with many other cauſes of the ſame kind. It renders the perſon dull, weak, and languid, and ſometimes almoſt totally oppreſſes him; nor are thoſe organs deſtined for moving the blood ſufficient for driving forward ſuch a load. The pulſe ſinks; and ſometimes a ſyncope, vertigo, or palpitation takes place. More frequently, however, the veſſels are too much diſtended, and ready to be thrown into violent and irregular motions. Hence a diſpoſition to fevers, inflammations, an unequal diſtribution of the blood, unuſual congeſtions, rupture of the veſſels, and hæmorrhages. Moreover, by reaſon of the cloſe connection between the ſanguiferous and the nervous ſyſtem, a fulneſs of blood produces a diſpoſition to ſpaſm and other diſeaſes of that kind.

Hence we may underſtand why a plethora is ſometimes accompanied with a weak and ſometimes with a ſtrong and hard pulſe, why it is the cauſe as well as a part of ſo many diſtempers, why it is the effect of a high ſtate of health, &c.

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The want of a due quantity of blood is no leſs pernicious than too great an abundance of it. It debilitates the perſon, and renders him unable to perform the proper offices of life; produces a languid circulation, ſyncope, ſpaſm, and at laſt death itſelf. In a ſlighter degree of the diſeaſe the body is emaciated through want of nouriſhment, and its functions are vitiated in various ways. It may ariſe from want, bad food, or ſuch as affords little nouriſhment: from bad digeſtion, or the chyle being hindered from paſſing into the blood; from fevers, or other diſeaſes which exhauſt the body and hinder nutrition: or laſtly, from various evacuations, particularly of blood: and that the more eſpecially if they are ſudden, for in ſlow evacuations the veſſels accommodate themſelves ſurpriſingly to the quantity left in them. Beſides, if the body be ſlowly exhauſted, the excretions are leſſened by reaſon of the deficiency of the vital power; ſo that the unuſual expence is eaſily compenſated by the unuſual retention. But if the evacuation happens to be very ſudden and great, it may either prove mortal in a ſhort time, or break the conſtitution to a degree beyond recovery.

101 Inanition.

101 Morbid thinneſs of the blood.

By a great and long continued deficiency of blood the quality of it alſo is impaired; becauſe the thin part of it is eaſily and ſoon made up; but the glutinous, thick, and red part, not ſo eaſily. Hence the blood becomes thin, pale, ſcarce capable of coagulation, or of affording a proper ſupport to the body. Too great thinneſs of the blood alſo proceeds from uſing much drink, eſpecially of the aqueous kind, ſlender and little nouriſhing diet, a bad digeſtion in the ſtomach; from diſeaſes of the lungs and thoſe organs which elaborate the red part; or from ſuppreſſions of the uſual evacuations of thin humours, as ſweat or urine, induced by cold, a fault of the ſecreting organs, or by putreſcency. But along with this other diſorders of the blood concur.

A too thin and watery blood makes the face pale, the body weak, languid, and torpid; the ſolid parts become flaccid from want of nouriſhment, and having too great a quantity of water in their compoſition. It brings on hydropic effuſions of water in all parts of the body, by reaſon of the increaſed exhalation of that thin fluid which moiſtens all the inward parts; partly by reaſon of the blood itſelf being in ſome meaſure diſſolved, ſo that it paſſes out of the veſſels more eaſily and plentifully than it ought to do; and partly by reaſon of the veſſels being relaxed beyond their uſual pitch, and not making a proper reſiſtance. Beſides, in this caſe, the lymphatics are ſo far from abſorbing more than uſual, that, partaking likewiſe of the general debility, they are ſcarce ſufficient for performing their proper offices.

Nature, however, has taken care, by the moſt ſimple means to provide againſt ſo many and ſo great evils; for neither does the blood ſo eaſily become thin as ſome have imagined, nor when this quality takes place does it want a proper remedy. For almoſt inſtantly, if the perſon be otherwiſe in health, the excretions of the thinner matters are greatly augmented, and the whole maſs of blood in a ſhort time becomes as thick as formerly.

[102] Morbid thickneſs of the blood.

The oppoſite to this, namely, too great a thickneſs of the blood though often ſpoken of by phyſicians, is very rarely if ever obſerved; and thoſe fevers and inflammations which have been thought to ariſe from thence, are now found to originate from other cauſes. The following would ſeem to be the law of the human conſtitution. As ſoon as the blood has attained the due degree of thickneſs, or gone in the leaſt beyond it, the excretions are either increaſed or diminiſhed, the body attracts more moiſture from the air, the perſon is thirſty, and drinks as much as is neceſſary for diluting the blood. But if water be wanting, and the perſon cannot ſatisfy his thirſt, the blood is ſo far from being thickened, that by reaſon of a putreſcency begun or augmented, it is much diſſolved, becomes acrid, and is with difficulty contained in the veſſels.

103 Acrimony of the blood.

The acrimony of the fluids has afforded a large field for declamation to the ſpeculative phyſicians, and upon this ſlender foundation many perplexed and intricate theories have been built. It is certain indeed, that the blood in a ſtate of health has ſome ſmall ſhare of acrimony; and this acrimony, from certain cauſes, may be a little increaſed ſo as to produce various diſeaſes of a dangerous nature. This we are aſſured of from the increaſe of motion in the heart and arteries, and the ſimilar augmentation of the action of the ſecretory organs, from acrid ſubſtances taken inwardly. The ſame thing alſo appears from the unuſual acrimony of the ſecreted fluids in ſuch caſes, by which the veſſels are ſometimes greatly ſtimulated, and ſometimes even quite eroded. Very many acrid ſubſtances, however, are daily taken into the ſtomach; ſo that theſe muſt either be corrected in the *primæ viæ*, or changed by digeſtion before they paſs into the blood; or at leaſt by dilution with much water, or being blunted by an admixture with gluten, oil, or inflammable air, they muſt depoſit much of their acrimony, and at laſt be thrown out of the body as noxious ſubſtances. Thus a vaſt quantity of ſalts, acid, alkaline, and neutral, may paſs through the body, without in the leaſt affecting the health; though theſe ſalts, if taken in very large quantity, undiluted, or not thrown out of the body, will do much hurt.

Moreover, even while life continues, putrefaction is going on, and produces much of that ſubſtance called *animal* ſalt; for into this a great part of our food is converted, and paſſes off by the urine. But if this putreſcent diſpoſition be too great, it will produce too large a quantity of animal ſalt; eſpecially if much of any ſaline ſubſtance is otherwiſe thrown into the body without proper dilution; and this kind of diſeaſe is well known to ſailors who have been long at ſea without having any opportunity of getting freſh proviſions.

For this ſpontaneous putreſcency, nature has ſuggeſted a proper remedy, namely, freſh meat, eſpecially of the vegetable and aceſcent kind, and ſuch as is well impregnated with aerial acid, which it may impart to the body. But where this kind of food is wanting, the putrefaction goes on apace, and a very great thinneſs and acrimony of the juices take place; eſpecially if there be alſo a ſcarcity of water, or the excretions which ought to carry the putrid matters out of the body languiſh, either from cold, ſloth, torpor, depreſſing paſſions of the mind, or from the conſtitution being broken by diſeaſes: or laſtly, from too great heat, which always favours putrefaction.

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Beſides, it would ſeem, that ſometimes a diſpoſition to putrefaction is much increaſed by the reception of a putrid ferment into the body; of which we have examples in ſome infectious fevers, where the contagion is very much aſſiſted by heat, animal-diet, certain kinds of ſalts, debility and naſtineſs.

Laſtly, any ſingle part of the body may putrefy from various cauſes, as from inflammation, gangrene, cold, &c. and thus may the whole body be infected; although for the moſt part the diſeaſe proves fatal before the corruption has ſpread over the whole body.

But when the maſs of blood begins to putrefy greatly, it not only becomes very acrid, but thin alſo, ſo that it either will not coagulate at all, or ſhows only a ſlight and very looſe craſſamentum. Nay, even the red globules are broke down and deſtroyed; in which caſe it neceſſarily follows, that the blood muſt become very acrid, as well on account of the evolution of the ſalt, as by reaſon of the rancid and putrid gluten, which ſtimulates, and frequently even erodes, the veſſels; producing ſpots, firſt red, then livid and black, tumors, and ulcers ſcarce poſſible to be cured, without firſt removing the putreſcent diſpoſition of the humours. From the ſame cauſes proceed hæmorrhages from every part of the body, hardly to be reſtrained; a moſt intolerable fetor of the breath and all the excrements; the higheſt debility and laxity of the ſolids; the putrefaction acting as a poiſon to the nervous ſyſtem, and at length bringing on death.

An acrimony of the acid kind never takes place in the human blood, nor in any of the humours ſecreted from it; though one of them, namely the milk, turns acid ſpontaneouſly in a very ſhort time after it is drawn from the breaſt. Neither, indeed, does an alkaline acrimony ſeem ever to take place in the blood. Putreſcency indeed tends this way, and at laſt terminates in it; but ſcarcely while the perſon lives, though the nature of the urine, even while recent, ſeems to be but little diſtant from that of an alkali.

Many kinds of acrimony indeed may exiſt in the blood from too liberal an uſe of ſpices, wine, &c. but of theſe we know nothing certain. We well know, however, that the body is often infected with various kinds of morbid acrimony, which bring on many and dangerous diſeaſes, as the ſmall-pox, meaſles, cancers, lues venerea, &c. of which the origin and manner of acting are very little underſtood, though the effects are abundantly evident. In moſt caſes, nature has taken no leſs care to provide againſt the *acrimony* than againſt the too great *thickneſs* of the blood. Sometimes an antidote is afforded, either by the excitement of thirſt, that the acrid ſubſtance may be diluted with plenty of drink; or by increaſing the evacuations, that it may be thrown out of the body; or laſtly, by exciting various motions and actions of the vital powers, by which it may be either ſubdued, changed, rendered innocent, or expelled from the body by new and unwonted paſſages.

104 Reſpiration.

With regard to reſpiration, Dr Gregory obſerves, that it may be obſtructed from various cauſes ſeated either in the lungs themſelves or the ſurrounding parts. But from whatever cauſe this obſtruction may ariſe, it undoubtedly produces all thoſe diſeaſes which proceed from an interrupted circulation. The lungs themſelves alſo being at length compreſſed, and not ſuffered to dilate ſufficiently, cannot throw off the vapour which ariſes from them; and hence they are frequently oppreſſed with moiſture. At the ſame time they are irritated, ſo that a greater quantity of mucus, and that of a thicker kind than uſual, is ſecreted; by which means the paſſages through which the air enters them are ſtopped up, and a violent cough at length throws off the load.

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The reſpiration is alſo ſubject to ſome other diſorders, as a cough and ſneezing; which, though at firſt ſight they may ſeem very dangerous, are not deſtitute of uſe, and may even be reckoned among the moſt ſalutary attempts of nature to relieve the patient. Often, however, they are attended with danger, or very great uneaſineſs; namely, when they are either too violent or exerted in vain. At any rate, it is neceſſary for a phyſician to know the nature, cauſes, and effects, of theſe, that he may be enabled to promote them when neceſſary, to moderate them when too violent, and to ſtop them when noxious or to no purpoſe.

105 Cough.

A cough is a violent, frequently involuntary, and ſonorous exſpiration, ſuddenly expelling the air with great force through the glottis ſomewhat contracted. The convulſion of the muſcles ſerving for exſpiration, gives a great force to the air, while the contraction of the glottis produces the ſound. It is often long continued, being repeated at certain intervals, during each of which the inſpiration is imperfect and obſtructed by reaſon of the contraction of the glottis. It is excited by any kind of acrid ſubſtance, either chemically or mechanically applied to thoſe paſſages through which the air enters. Theſe are lined with a membrane ſo exceedingly delicate and impatient of ſtimulus, that it cannot even bear the touch of the mildeſt ſubſtance, ſuch as a ſmall drop of water, without throwing the muſcles ſerving for exſpiration into a violent convulſion; the glottis at the ſame time contracting by means of the ſympathy between it and the neighbouring parts. Thus the air is thrown out with ſuch violence, that it drives the irritating ſubſtance along with it; and thus a cough becomes not only uſeful, but abſolutely neceſſary for the preſervation of life, as being able to free the lungs from every kind of irritating ſubſtance or foulneſs, which might ſoon bring on a ſuffocation. Hence a cough is almoſt an inſeparable companion of every inflammation of the lungs, as well as every difficulty in reſpiration; and even frequently accompanies the entrance of the pureſt air when the trachea and bronchiæ are excoriated, or become too ſenſible. Examples alſo are not wanting, where a violent and troubleſome cough has ariſen from an irritation of the nervous ſyſtem, or even of ſome particular part, of the ear, for inſtance, the ſtomach and inteſtines by worms, the liver by inflammation, &c.

Coughing may alſo be voluntarily excited, and may then be managed at pleaſure. Even when involuntary, it may be moderated, or ſuppreſſed, by a contrary effort: though a violent fit of coughing cannot by any means be reſiſted. When it is once excited, the cough goes on till the irritating ſubſtance be expelled, or the ſenſe of irritation aboliſhed, or perhaps overcome by a more uneaſy ſenſation than even the cough itſelf; after,

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ter which, the irritation again returning at a certain interval, the cough alſo comes on. Hence we are taught a method of allaying and quieting this moſt troubleſome malady, though frequently it is not in our power to remove the cauſe of it altogether.

A very violent cough is often dangerous. For by the retention of the breath, and the ſtrong efforts made in coughing, a great quantity of blood is collected in the lungs, of which the veſſels are diſtended, and frequently broken; and hence there ſometimes happens a violent and even fatal hemorrhage. More frequently, however, it is the cauſe of a flower, though equally fatal, diſeaſe. Nay, a frequent and troubleſome cough, without any great hemorrhage, or even without any hemorrhage at all, may damage the lungs to ſuch a degree, eſpecially if they be of a more tender ſtructure than uſual, as to lay the foundation of a phthiſis almoſt always incurable.

Again, by a long-continued and violent cough, the paſſage of the blood through the lungs being impeded, it muſt neceſſarily flow through the veins towards the head: hence redneſs and lividneſs in the countenance, hemorrhages, palſies, apoplexies, and ſometimes mortal convulſions. Laſtly, by a violent cough the abdominal viſcera are perpetually compreſſed with remarkable violence; and if any part happens to be weaker than uſual, a hernia, prolapſus uteri, abortion, or ſimilar accidents, may happen.

Even when the cough is more gentle, if it happens to be importunate and frequent, although we have nothing of this kind to fear, yet the patient is by no means free from danger; as he is thereby agitated, fatigued, has his conſtitution broken, is deprived of reſt, has a fever brought upon him, his lungs are ſhaken and irritated, digeſtion and all the other functions are impeded, till at laſt he ſinks under a complication of maladies.

106 Sneezing.

Sneezing is ſomewhat akin to cough, as conſiſting of a very full inſpiration, to which ſucceeds a moſt violent exſpiration, by which the air is driven out through the noſtrils with immenſe violence, and ſweeps the paſſage through them as it goes out. It is a convulſion much more violent than a cough, and is beſides very difficult to be ſtopped when once a propenſity to it has taken place. As a cough proceeds from an irritation of the glottis, trachea, bronchia, and lungs, ſo ſneezing ariſes from an irritation of the membrane of the noſtrils, but rarely from ſympathy with any diſtant part. It is ſometimes of ſervice, as well as a cough; though it is alſo ſometimes prejudicial, for the reaſons which have been already aſſigned.

107 Digeſtion.

The laſt part of Dr Gregory's treatiſe neceſſary to be taken notice of here, is that which conſiders diſeaſes ariſing from a bad digeſtion, diſordered motion of the inteſtines, and ſome of the principal ſecretions. The firſt of theſe, he ſays, are ſometimes very troubleſome, though ſeldom dangerous. The principal ſymptoms are oppreſſion, anxiety, pain at the ſtomach; eructation, by reaſon of air extricated from the fermenting aliments, and irritating the ſtomach; nauſea and vomiting, from the irritation and diſtenſion of the ſame organ; the belly ſometimes too coſtive, and ſometimes too looſe; a defect of nouriſhment; a general debility; relaxation of the ſolid parts; too great thinneſs of the fluids; all the functions impeded; pain of the head; vertigo, ſyncope, aſthma, palpitation; great ſinking of the ſpirits, eſpecially if the patient has been of a peculiar conſtitution; ſometimes the gout, ſometimes a dropſy, or a ſlow fever which may prove mortal.

Diſorders of Digeſtion.

108 Coſtiveneſs.

The motion of the inteſtines may be either too great or too little; and hence proceeds either coſtiveneſs or looſeneſs. The former is frequently not to be accounted morbid; but, when it is, it may ariſe from the ſtructure of the inteſtines being injured, or from their being ſhut up or obſtructed by ſpaſm or otherwiſe, or from a deficiency of thoſe humours which moiſten the inteſtines; or it may ariſe from mere debility, from a palſy of the fibres perhaps, or from a deficiency of the uſual ſtimulus, of the bile, for inſtance, or from too dry or ſlender a diet.

The conſequences of long-continued coſtiveneſs, are firſt an affection of the alimentary canal, and, then of the whole body. The ſtomach is diſeaſed, and does not digeſt the aliments properly; the whole body is left deſtitute of its uſual ſtimulus; the blood is corrupted, perhaps from the reſorption of the putrid matter into it. The circulation through the abdominal viſcera is impeded; hence frequent and irregular congeſtions, varices of the veins, hemorrhoids, &c. Nay the inteſtines themſelves being overloaded, diſtended and irritated by an heavy, acrid, and putrid load of aliment or other matters, are excited to new and unuſual contractions, which, if they do not get the better of the obſtruction, bring on tormina, colic, or an iliac paſſion, inflammation and gangrene, fatal in a very ſhort time.

109 Looſeneſs.

Looſeneſs, or diarrhœa, is a malady extremely common; being ſometimes a primary diſeaſe, and ſometimes only a ſymptom or an effect of others. Sometimes it is a ſalutary effort of nature, ſuch as the phyſician ought to imitate and bring on by art. It is alſo familiar to infants, and to people of a certain conſtitution; and to them coſtiveneſs is very prejudicial. It may ariſe, in the firſt place, from ſomething taken into the body, or generated in the inteſtines; from a fermentation and corruption of the maſs of aliments; from the bile being too abundant and acrid, or from blood or pus poured into the inteſtines; from the inteſtines themſelves being eroded, or deprived of their natural mucus; from the humours being driven from the ſurface of the body towards the inward parts, as by cold, eſpecially when applied to the feet; or from a general corruption of the whole body, as in the phthiſis, hectic, or putrid fever, eſpecially towards the end of theſe diſorders. In fevers it is ſometimes ſalutary, or even puts an end to the diſeaſe altogether, or at leaſt renders it milder: more frequently, however, deriving its origin from putreſcency, it is of no ſervice, but rather exhauſts the ſtrength of the patient. A diarrhœa likewiſe, almoſt incurable, and often mortal in a ſhort time, frequently ariſes after the operation for the fiſtula in ano. Some have their inteſtines ſo extremely weak and moveable, that from the ſlighteſt cauſe, ſuch as catching cold, any violent commotion of the mind, &c. they are ſubject to a violent diarrhœa. Laſtly, whatever be its origin, if it hath continued for a long time, the viſcera are rendered ſo weak and irritable,

Disorders of the Alimentary Canal.

ritable, that the disease, though often removed, still returns from the slightest causes, and even such as are not easily discovered.

A diarrhœa proves very pernicious, by hindering digestion and the nourishment of the body; for the stomach is commonly affected, and the aliments pass through the intestines so quickly, that they can neither be properly digested, nor are the lacteals able to absorb the chyle from them as they go along. Such a violent evacuation is also hurtful by exhausting the body, and carrying of a great quantity of the nutritious matter from the blood. Neither, indeed, is it only the alimentary mass which is thrown out sooner than it ought to be; but at the same time, a great quantity of the fluids secreted in the intestines, so that the whole body quickly partakes of the debility.

Sometimes a violent and long continued diarrhœa rises to such a height, that the aliment is discharged with little or no alteration. Sometimes also, though rarely, from a similar cause, or from the obstruction of the mesenteric glands, and its other passages into the blood, the chyle itself is thrown out like milk along with the excrements; and this disease is called the *fluxus cœliacus*.

110 Dysentery. A dysentery is attended with very severe gripes in the belly, a frequent desire of going to stool, and vain efforts which excrete nothing besides the mucus of the intestines mixed with a little blood; and is accompanied with excessive debility, and frequently with putrescency and fever. It is thought to arise from the constriction of some part of the intestines, of the colon especially: by which means the bowels, though ever so much irritated, can pass nothing; neither can the disease be removed until the belly has been well purged by proper medicines.

111 Tenesmus. A tenesmus is a frequent and insatiable propensity to stool, without being able to pass any thing, notwithstanding the most violent efforts. It may be occasioned by any kind of irritation, either of the rectum itself or of the neighbouring parts, by acrid substances taken into the body; by some of the stronger purges, especially aloes, which is very difficult of solution, and will pass even to the rectum with very little alteration; by a violent and obstinate diarrhœa, dysentery, hæmorrhoids, worms, fistula, calculus, ulcer in the bladder, urethra, &c. It is often very pernicious, both from the excessive uneasiness it occasions to the patient, and from its exhausting his strength, by the frequent and vain efforts bringing on a prolapsus ani, and communicating the violent irritation to the neighbouring parts, as the bladder, &c.

112 Nausea and vomiting. A nausea and vomiting are disorders very common, and owing to almost innumerable causes: not only to affections of the stomach itself, but also to affections and irritations of the remotest parts of the body which may act upon the stomach by sympathy. Every irritation and distention of that viscus therefore, a load of crude aliment, an obstruction about the pylorus, all acrid substances taken into it, diseases of the liver, intestines, kidneys, uterus, the head, the feet, the skin or indeed the whole body, inflammation, the stone, king's evil, scirrhus, apoplexy, compression of the brain, fracture of the skull, vertigo, syncope, violent pain, the gout, especially when repelled, fevers, passions of the mind, disagreeable imaginations or discourses, frequently induce nausea and vomiting.

These affections are often serviceable by freeing the stomach from something with which it was overloaded; promoting spitting in some cases where the lungs are overcharged with mucus, blood, pus, or water; producing sweat, and a free and proper distribution of blood to the surface of the body; partly, perhaps, by the great straining which accompanies vomiting, but rather by that wonderful sympathy which takes place between the stomach and skin: and hence, in many diseases, vomiting is a most excellent remedy. It is however in some cases hurtful, if too violent or too frequently repeated, partly by debilitating and making the stomach more easily moved; and partly by fatiguing the patient with violent strainings, which occasion hernias, abortions, &c.

113 Iliac passion. Sometimes we find the motion of the intestines totally inverted, from the anus to the mouth; a most dangerous distemper, which hath obtained the name of the *iliac passion*. It most frequently arises from some obstruction in the alimentary canal hindering the descent of the excrements, as scirrhus, spasm, inflammation, &c.: though the most perfect iliac passion takes place without any obstruction, so that clysters will be vomited; and even after this has continued for several days, the patients have at length recovered.

A slighter degree of the iliac passion, namely the inversion of the peristaltic motion of the duodenum, always takes place in long continued and violent vomiting, as in sea-sickness, or when a person has taken too large a dose of an emetic; by which means a vast quantity of bile frequently ascends into the stomach, and is discharged by vomiting.

114 Cholera. An excessive vomiting with looseness is called a *cholera*, when the matter discharged has a bilious appearance. It arises from a very great irritation of the alimentary canal without any obstruction; and is for the most part occasioned by too great a quantity, or from an acrimony of the bile, from whence it takes its name. It may originate from several causes, as too strong a dose of an emetic and cathartic medicine, eating too great a quantity of summer-fruits, &c. and is a very violent malady, often killing the patient in a few hours, unless proper remedies be applied in time.

115 Obstructed perspiration. From a suppression of any of the secretions, or a disorder of any of the secretory organs, many mischiefs may arise. A diminution of perspiration produces plethora, lassitude, languor, depression of mind, bad digestion, loss of appetite, and even a general corruption of the humours from the retention of such a quantity of putrescent matter.—The more suddenly the diminution or suppression of the perspiration takes place, the sooner the mischief is produced, and the greater it is; not only by retaining the matter which ought to be thrown out, but by repelling the humours from the surface of the body, and directing them to other parts; whence fevers, inflammations, congestions of the blood, &c. frequently take place.

Thus suppression of perspiration may arise from many different causes; as from cold suddenly applied to the body when very hot; sometimes from very violent passions

Disorders of Secretion.

passions of the mind; or from spasmodic diseases, as the hysterics, &c. It may be suppressed also by that kind of constriction of the vessels of the skin which is produced by various kinds of fevers, the nature of which has hitherto been but little known.

116 Excessive perspiration.

Excessive perspiration or sweating is injurious by debilitating the body, relaxing the skin, and exposing the patient to all the evils which arise from catching cold. It may even be carried to such a height as to produce fainting and death; though it must be owned that we cannot easily bring examples of people having from this cause their blood inspissated, corrupted, or being thence made liable to inflammations and fevers.

117 Suppression of urine.

A suppression of urine is still more dangerous than that of perspiration, and unless relieved in a short time will certainly prove fatal. This disorder, which is called *ischuria*, may arise from various diseases of the kidneys, ureters, bladder, urethra, &c. Thus any obstruction or irritation of one or other of the kidneys or ureters, by a stone, gravel, mucus, blood, inflammations, spasm, suppuration, scirrhus, swellings of the neighbouring parts, &c. may either prevent the urine from being secreted, or may give rise to a scanty or depraved secretion, or finally may obstruct its passage into the bladder after it is secreted.

The urine also, after it has entered the bladder, is there frequently suppressed, by reason of various disorders to which that organ is liable, as an irritation or inflammation, spasm, acrid substances injected, or sympathy with the neighbouring parts; or by reason of the texture of the bladder itself being destroyed, or from a palsy, scirrhus, ulcer, &c. in the bladder. Or, lastly, the urine may be retained in the bladder from a general stupor, as from a disease of the brain, which happens in some fevers, when the patient is neither sensible of the usual stimulus, nor even of one much greater, so that the fibres can scarcely be excited to contraction by any means whatever. This, in fevers, is always a bad sign, and sometimes even proves fatal.

A suppression of urine for any length of time produces an immense distension of the bladder, oppression, uneasiness, and pain, not only of the part itself, but of the surrounding ones, and even of the whole body; a spasm, or insuperable constriction of the sphincter; an inflammation, gangrene, or laceration of the bladder itself: a violent irritation of the whole habit; then a nausea, vomiting, vertigo, general stupor, and an impregnation of the whole mass of blood with a humour of an urinous nature, which at last being poured out into various cavities of the body, especially of the head, soon brings on a deep sleep, convulsions, and death.

118 Dysuria.

From the same causes, but acting with less force, proceeds that disease called a *dysuria*, when the urine passes with difficulty and pain, and is frequently red, black, bloody, purulent, mucous and sandy; the reason of which appearances is very much unknown.—The most frequent complaint, however, in making water, is where the patient has a continual and violent desire of passing his urine, while at the same time only two or three drops can be passed at once, and that not without some pain. This is occasioned even in healthy people, by some acrid substance taken into the stomach; and is very common to old people, who are generally subject to disorders of the kidneys and bladder. It arises also frequently from a stone irritating the bladder, or from an inflammation of it, or its being deprived of its mucus, or this last being somehow or other corrupted; or lastly, from certain diseases or some particular state of the neighbouring parts, as of the uterus, vagina, urethra, prostrate gland, &c.

119 Strangury.

120 Incontinence of urine.

Akin to the strangury is an incontinence of urine, when the patient's water either comes away against his will, or altogether without his knowledge. This disorder may arise from debility, palsy, an ulcer or wound, or any long-continued and violent irritation of the bladder, especially of its sphincter, as from a stone, a general palsy, or in females, difficult labour injuring the neighbouring parts.—This symptom occurs in a great number of diseases, especially in the hydrocephalus.—Sometimes the urine is expelled with violence, either by reason of universal spasms, or by violent contractions of the muscles of respiration, as in sneezing, laughter, &c.

121 Urinary calculi.

Among the disorders incident to the urine we may reckon the production of calculi, which frequently bring on the most excruciating and dangerous diseases. —The urine, besides the water and salts, contains no small share of the glutinous part of the blood already somewhat corrupted, and still inclined to farther corruption. Hence the urine even of the most healthy people deposits a sediment after it has stood for some time; and though none of this sediment be formed in an healthy body, yet if the smallest particle of foreign matter be introduced into the bladder, a crust soon gathers round it, and it is sure to become the basis of a stone, which by degrees grows to a very great size. It is not unlikely, also, that some unknown fault of the fluids may contribute to the production of those calculi, as the stone is well known to be an hereditary disease, and to be born with the patient. Calculous persons also are commonly subject to complaints of the stomach, especially to an acidity of it; and many have received no little relief from alkalescent or alkaline medicines.—From the same causes may calculi be formed in the kidneys; from which proceed a horrid train of symptoms described in the subsequent part of this treatise.

It is now found by accurate experiments of the most able chemists, that urinary calculi do not, as was once supposed, consist almost entirely of an earthy matter. Their principal constituent is a peculiar acid approaching more nearly to the phosphoric found in the bones than to any other. But the acid of calculus being in some respects peculiar in its nature, has among modern chemists obtained a peculiar name, and been distinguished by the appellation of the *lithic acid*. It is highly probable that this acid present in the circulating mass, is precipitated and disengaged by the introduction of other acids, and thus thrown off in greater quantities by the kidneys. Thus then we can understand the influence of acids as tending to the generation of calculus, and of alkalies as tending to prevent it.

122 Schirrhus.

The last disorder here to be taken notice of is a disorder of the glands themselves, owing to some kind of obstruction, and is one of the most dreadful diseases incident to human nature. Hence happens a great

Scirrhus.

great swelling and surprising hardness, not only without pain, but sometimes even with a diminution of sensation in the part affected; and when the gland is thus affected, it is called a *scirrhus*. Sometimes it remains in this state for a long time; but sooner or later produces the most excruciating torment. By degrees it is affected with a slow and malignant suppuration, degenerating into an horrid ulcer, consuming not only the part itself, but eating away the neighbouring ones, and corrupting the whole body with the most acrid and incurable poison. This disease is called a *cancer*, of which the causes are very little known.

Versatility of the Human Constitution.

Of the organs in both sexes concerned in the function of generation, and of that function as far as we yet know any thing respecting it, an account has already been given in ANATOMY; and after what has already been said of the different functions, and of the morbid affections, to which these are subjected, we may conclude our remarks on the theory of medicine, with mentioning the remarkable versatility of the human constitution; which, more than that of any other animal, is capable of accommodating itself to every climate, and to all kind of diet. Hence we may conclude, that a large proportion of the diseases to which we are subjected are produced by ourselves.

PRACTICE of MEDICINE, or an Account of the principal Diseases to which the Human Body is subjected.

123 General Arrangement of Diseases.

WE have already defined medicine to be the art of preventing, curing, and alleviating, these diseases to which mankind are subjected. While these affections, however, are in number almost infinite, each in its progress is subjected to almost endless varieties from differences in climate, constitution, treatment, and a variety of other particulars. Hence we may readily explain both the difficulty of distinguishing morbid affections from each other in actual practice, and the diversity of names which have been affixed to them in the writings of ancient physicians. It may readily be supposed, that in this as well as other subjects, there has been a gradual improvement from the progressive labours of industrious and ingenious men. And although much yet remains to be done in the proper arrangement and distinction of diseases, or what has been called *methodical nosology*, yet there cannot be a doubt, that during the course of the present century, this subject has received very great improvements. For these, we are in the first place highly indebted to the labours of Franciscus Boissier de Sauvages, an eminent professor of medicine at Montpelier, who, following out an idea suggested by the sagacious Dr Sydenham of England, first successfully attempted to arrange diseases as botanists had done plants, into classes, orders, genera, and species. Since the publication of the *Nosologia Methodica* of Sauvages, this subject has been successfully cultivated by several ingenious men, particularly by Sir Charles Linnæus of Upsal, to whose genius for arrangement every branch of natural history, but botany in particular, has been so highly indebted; by Rodolphus Augustus Vogel, an eminent professor at Gottengen: and by John Baptist Sagar, a distinguished physician at Iglaw in Moravia: but of all the systems of arrangement yet presented to the medical world, that published by the late illustrous Dr William Cullen of Edinburgh, may justly be considered as the best. In treating, therefore, of the principal diseases to which the human body is subjected, we shall follow his plan, endeavouring to deliver the best established observations respecting the history, theory, and practice of each. And in treating of particular genera of diseases, although we follow the arrangement of Dr Cullen, yet for the satisfaction of the reader, we shall point out the classes to which the same affection is referred by the other eminent writers whom we have mentioned. And on this account, it may not be improper briefly to enumerate the general classes to which each of them have referred the affections of the human body.

The classes of Sauvages are,

1. Vitia.	6. Debilitates.
2. Febres.	7. Dolores.
3. Phlegmasiæ.	8. Vesaniæ.
4. Spasmi.	9. Fluxus.
5. Anhelationes.	10. Cachexiæ.

The classes of Linnæus are,

1. Exanthematici.	7. Motorii.
2. Critici.	8. Suppressorii.
3. Phlogistici.	9. Evacuatorii.
4. Dolorosi.	10. Deformes.
5. Mentales.	11. Vitia.
6. Quietales.	

The classes of Vogel are,

1. Febres.	7. Hyperæstheses.
2. Profluvia.	8. Cachexiæ.
3. Epischeses.	9. Paranoiæ.
4. Dolores.	10. Vitia.
5. Spasmi.	11. Deformitates.

The classes of Sagar are,

1. Vitia.	8. Anhelationes.
2. Palgæ.	9. Debilitates.
3. Cachexiæ.	10. Exanthemata.
4. Dolores.	11. Phlegmasiæ.
5. Fluxus.	12. Febres.
6. Suppressiones.	13. Vesaniæ.
7. Spasmi.	

After this short view of different classifications, we shall next present to our readers a more particular account of the arrangement of Dr Cullen; which, although it can by no means be represented as free from errors or imperfections, is yet in many respects the best that has hitherto been published.

CULLEN'S *Arrangement*.

CLASS I. PYREXIÆ. A frequent pulse coming on after an horror; considerable heat; many of the functions

General Arrangement of Diseases.

tions injured; the strength of the limbs especially diminished.

Order I. Febres. Pyrexia without any primary local affection, following langour, lassitude, and other symptoms of debility.

Sect. I. *Intermittentes.* Fevers arising from the miasma of marshes; with an apyrexia, or at least a very evident remission; but the disease returns constantly, and for the most part with a horror or trembling. There is only one paroxysm in a day.

Genus I. Tertiana. Similar paroxysms at an interval of about 48 hours, coming on most commonly at mid-day. A tertian heat either;

I. An apyrexia interposed;

1. Varying the duration of the paroxysms.

A. The tertian whose paroxysms are not extended beyond 12 hours,

B. The tertian with paroxysms extended beyond 12 hours

2. Varying in the return of the paroxysms.

C. The tertian returning every day with unequal paroxysms alternately similar to one another.

D. The tertian returning every third day with two paroxysms on the same day.

E. The tertian returning every day, with two paroxysms on every third day, and only one on the intermediate ones.

F. The tertian returning every day, with a notable remission interposed between the odd and the even days, but a less remarkable one between the even and the odd one.

3. Varying in its symptoms.

G. The tertian accompanied with a disposition to sleep.

H. Accompanied with spasm and convulsive motions.

I. Accompanied with an efflorescence on the skin.

K. With phlegmasia.

4. Varying in being complicated with other diseases.

5. Varying as to its origin.

II. With the interposition only of a remission between the paroxysms.

Genus II. Quartana. Similar paroxysms, with an interval of about 72 hours, coming on in the afternoon.

I. With the interposition of an apyrexia.

1. Varying in the type.

A. The quartan with single paroxysms, returning every fourth day, none on the other days.

B. With two paroxysms every fourth day, and none on the other days.

C. With three paroxysms every fourth day, and none on the intermediate days.

D. Of the four days having only the third free from fever, with similar paroxysms every fourth day.

E. The quartan coming on every day, with similar paroxysms every fourth day.

2. Varying in its symptoms.

3. Varying in being complicated with other diseases.

II. With a remission only between the paroxysms.

Genus III. Quotidiana. Similar paroxysms with an inverval of about 24 hours, coming on in the morning.

I. With the interposition of apyrexia.

1. Varies in being solitary.

A. Universal.

B. Partial.

2. Complicated with other diseases.

II. With a remission only between the paroxysms.

Sect. II. *Continuæ.* Fevers without any intermission, and not occasioned by marsh miasmata; attended with exacerbations and remissions, though not very remarkable.

Genus IV. Synocha. Great heat; a frequent, strong, and hard pulse; high-coloured urine; the functions of the sensorium a little disturbed.

Genus V. Typhus. A contagious disease; the heat not greatly above the natural; the pulse small, weak, and for the most part frequent; the urine little changed; the functions of the sensorium very much disturbed, and the strength greatly diminished.

The species are,

I. Typhus *petechialis.* Typhus for the most part with petechiæ.

Varying in degree. 1. Mild typhus. 2. Malignant typhus.

II. Typhus *icterodes.* Typhus with a yellowness of the skin.

Genus VI. Synochus. A contagious disease. A fever composed of a synocha and typhus; in the beginning a synocha, but towards the end a typhus.

Order II. Phlegmasiæ. A synocha fever, with inflammation or topical pain, the internal function of the part being at the same time injured; the blood covered with size.

Genus VII. Phlogosis. Pyrexia; redness, heat, and painful tension, of some external part.

The species are,

I. Phlogosis (*phlegmone*) of a vivid red colour; a swelling well defined, for the most part elevated to a point, and frequently degenerating into an abscess, with a beating or throbbing pain.

The variations are, 1. In the form. 2. In the situation.

II. Phlogosis (*erythema*) of a reddish colour, vanishing by pressure; of an unequal and creeping circumference, with scarce any swelling; ending in the scaling off the cuticle, in phlyctenæ, or blisters.

The variations are, 1. In the degree of violence. 2. In the remote cause. 3. In being complicated with other diseases.

The consequences of a phlogosis are, an imposthume, gangrene, sphacelus.

Genus VIII. Ophthalmia. A redness and pain of the eye, with an inability to bear the light; for the most part with an effusion of tears.

The species and varieties of the ophthalmia are,

I. Idiopatic.

1 Ophthalmia (*membranarum*), in the tunica adnata, and the membranes lying under it, or the coats of the eye.

A. Varying in the degree of the external inflammation.

B. In the internal coats affected.

2. Ophthalmia (*tarsi*) of the eye-lids, with swelling, erosion, and glutinous exsudation.

II. Symptomatic.

1. From a disease of the eye itself.

2. From

General Arrangement of Diseases.

2. From diseases of other parts, or of the whole body.

Genus IX. Phrenitis. Violent pyrexia; pain of the head; redness of the face and eyes; inability to endure the light or any noise; watchfulness: a fierce delirium, or typhomania.

I. Idiopathic.

II. Symptomatic.

Genus X. Cynanche. Pyrexia sometimes inclining to a typhus; difficulty of swallowing and breathing; with a sensation of narrowness in the fauces.

The species are,

I. Cynanche (*tonsillaris*) affecting the mucous membrane of the fauces, but especially the tonsils, with redness and swelling, accompanied with a synocha.

II. Cynanche (*maligna*) affecting the tonsils and mucous membrane of the fauces with swelling, redness, and mucous crusts of a whitish or ash-colour, creeping, and covering ulcers; with a typhus fever and exanthemata.

III. Cynanche (*trachealis*) attended with difficult respiration, noisy and hoarse inspiration, loud cough, without any apparent tumor in the fauces, somewhat difficult deglutition, and a synocha.

IV. Cynanche (*pharingæa*) attended with redness in the bottom of the fauces, very difficult and painful deglutition, respiration sufficiently free, and a synocha.

V. Cynanche (*parotidæa*) with great swelling of the parotids and maxillary glands appearing on the outside; the respiration and deglutition but little injured; a synocha, for the most part mild.

Diseases of this genus are symptomatic, either from external or internal causes.

Genus XI. Pneumonia. Pyrexia, with a pain in some part of the thorax, difficult respiration, and cough. The species are.

I. Peripneumony, with a pulse not always hard, but sometimes soft; an obtuse pain of the breast; the respiration always difficult; sometimes the patient cannot breathe unless in an upright posture; the face swelled, and of a livid colour; the cough for the most part moist, frequently bloody.

1. Simple idiopathic peripneumonies.

Varying in degree.

2. Idiopathic peripneumonies complicated with fever.

3. Symptomatic peripneumonies.

II. Pleurisy, with a hard pulse; for the most part attended with a pungent pain of one side, augmented chiefly during the time of inspiration; an uneasiness when lying on the side; a most painful cough, dry in the beginning of the disease, afterwards moist, and frequently bloody.

1. Simple idiopathic pleurisies.

2. Pleurisies, complicated (1.) With fever. (2.) With catarrh.

3. Symptomatic pleurisies.

4. False pleurisies.

The consequences of pleurisy are a vomica or empyema.

Genus XIII. Carditis. Pyrexia; pain about the heart; anxiety; difficulty of breathing; cough; unequal pulse; palpitation of the heart, and fainting.

I. Idiopathic.

II. Symptomatic.

Genus XIV. Peritonitis. Pyrexia; pain of the belly, exasperated by an upright posture, without the proper signs of other abdominal phlegmasiæ. If the diagnostics of the following disease are given, they may be reckoned as so many species of this genus.

I. Peritonitis (*propria*) situated in the peritonæum, properly so called, surrounding the inside of the abdomen.

II. Peritonitis (*omentalis*) in the peritonæum extended through the omentum.

III. Peritonitis (*mesenterica*) in the peritonæum spread through the mesetery.

Genus XV. Gastritis. Pyrexia inclining to a typhus; anxiety; pain and heat of the epigastrium, augmented when any thing is taken into the stomach; an inclination to vomit, and an immediate rejection of every thing swallowed; an hickup.

I. Idiopathic.

1. From internal causes.

A. Gastritis (*phlegmonodea*) attended with acute pain and violent pyrexia.

2. From external causes.

B. Gastritis (*erysipelatosa*), with a less violent fever and pain; an erysipelatous redness appearing on the fauces.

II. Symptomatic.

Genus XVI. Enteritis. Pyrexia of a typhous nature; pungent pain of the belly, stretching and twisting round the navel; vomiting; the belly obstinately bound.

I. Idiopathic.

1. Enteritis (*phlegmonodæa*), with acute pain, violent fever, vomiting, and constipation of the belly.

2. Enteritis (*erysipelatosa*) with less acute fever and pain, without vomiting; but accompanied with a diarrhœa.

II. Symptomatic.

Genus XVII. Hepatitis. Pyrexia; tension and pain of the right hypochondrium; sometimes pungent like that of a pleurisy, but more frequently obtuse; a pain reaching to the clavicle and top of the right shoulder; a difficulty of lying on the left side; dyspnœa; dry cough, vomiting, and hickup.

Genus XVIII. Splenitis. Pyrexia; tension, heat, and swelling of the left hypochondrium, the pain increasing by pressure; without the signs of nephritis.

Genus XIX. Nephritis. Pyrexia; pain in the region of the kidney, often following the course of the ureter; frequent making of water, either thin and colourless, or very red; vomiting; stupor of the thigh; with a retraction or pain of the testicle of the same side. The species are,

I. Idiopathic. Spontaneous.

II. Symptomatic.

Genus XX. Cystitis. Pyrexia; pain and swelling of the hypogastrium, frequent and painful making of water, or ischuria; and tenesmus. The species are,

I. These arising from internal causes.

II. Those from external causes.

Genus XXI. Hysteritis. Pyrexia; heat, tension, swelling,

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ſwelling, and pain of the hypogaſtrium; the os uteri painful when touched; vomitting.

Genus XXII. Rheumatiſmus. A diſeaſe ariſing from an external and frequently very evident cauſe; pyrexia; pain about the joints, frequently purſuing the courſe of the muſcles; infeſting the knees and other large joints rather than thoſe of the feet or hands; increaſed by external heat.

The ſpecies are either idiopathic or ſymptomatic. The former varies in ſituation.

A In the muſcles of the loins.
B. In the muſcles of the coxendix.
C. In the muſcles of the breaſt.

Genus XXIII. Odontalgia; a rheumatiſm of the jaws from a caries of the teeth.

Genus XXIV. Podagra. An hereditary diſeaſe, ariſing without any evident external cauſe, but for the moſt part preceeded by an unuſual affection of the ſtomach; pyrexia; pain of a joint for the moſt part of the great toe of the foot, at leaſt infeſting chiefly the wriſts and ankles; returning by intervals; and often alternated with the affections of the breath and other internal parts.

I. Podagra (*regularis*) with a pretty violent inflammation of the joints remaining for ſome days, and by degrees going off with ſwelling, itching, and deſquamation of the affected part.

II. Podagra (*atonica*) with an atony of the ſtomach, or ſome other internal part; and either without the uſual inflammation of the joints, or only with ſlight and wandering pains; and frequently alternated with dyſpepſia, or other ſymptoms of atony.

III. Podagra (*retrograda*) with the inflammation of the joints ſuddenly receding, and an atony of the ſtomach and other parts immediately following.

IV. Podagra (*aberrans*) with the inflammation of an internal part either preceding or not, and ſuddenly receding; with an inflammation of the joints.

Genus XXV. Arthropuoſis. Deep, obtuſe, and long-continued pains of the joints or muſcular parts, frequently following contuſions; with either no ſwelling, or a moderate and diffuſed one; no phlogoſis; pyrexia, at firſt gentle, afterwards hectic, and at length an impoſthume.

Order III. Exanthemata. Contagious diſeaſes; affecting a perſon only once in their life; beginning with fever; after a certain time appear phlogoſes, for the moſt part ſmall and in conſiderable number, and diſperſed over the ſkin.

Genus XXVI. Eryſipelas. A ſynocha of two or three days, for the moſt part attended with drowſineſs, often with a delirium. In ſome part of the ſkin, moſt frequently the face, appears a phlogoſis *erithema*. (G. VII. Sp. 2.) The ſpecies are,

I. Eryſipelas (*veſiculoſum*) with erythema, redneſs creeping, occupying a large ſpace, and in ſome parts ending in large bliſters.

II. Eryſipelas (*phlyctænodes*), with an erythema formed of a number of papulæ, chiefly occupying the trunk of the body, ending in phlyctenæ or ſmall bliſters.

The diſeaſe is alſo ſymptomatic.

Genus XXVII. Peſtis. An exceedingly contagious typhus, with the higheſt debility. On an uncertain day of the diſeaſe buboes and carbuncles break forth. It is various in degree, but the ſpecies are uncertain.

Genus XXVIII. Variola; a contagious ſynocha, with vomiting, and pain on preſſing the epigaſtrium. On the third day begins, and on the fifth is finiſhed, the eruption of inflammatory puſtules, which ſuppurate in the ſpace of eight days, and at laſt go off in cruſts, frequently leaving depreſſed cicatrices or pockpits in the ſkin. The ſpecies are,

I. Variola (*diſcreta*) with few, diſtinct, turgid puſtules, having circular baſes; the fever ceaſing immediately after the eruption.

II. Variola (*confluens*) with numerous, confluent, irregularly ſhaped puſtules, flaccid, and little elevated; the fever remaining after the eruption.

Genus XXIX. Varicella. Synocha; papulæ breaking out after a ſhort fever, ſimilar to thoſe of the ſmall pox, but hardly ever coming to ſuppuration; after a few days going off in ſmall ſcales, but never leaving any mark.

Genus XXX. Rubeola. A contagious Synocha, with ſneezing, epiphora, and dry hoarſe cough. On the fourth day, or a little later, break forth ſmall, cluſtered, and ſcarce elevated papulæ: after three days going off in very ſmall branny ſcales.

I. Rubeola (*vulgaris*) with very ſmall confluent, corymboſe papulæ, ſcarce riſing above the ſkin.

Varying,

1. In the ſymptoms being more ſevere, and the courſe of the diſeaſe leſs regular.
2. In being accompanied with a quinſey.
3. With a putrid diatheſis.

II. Rubeola (*variolodes*) with diſtinct papulæ, raiſed above the ſkin.

Genus XXXI. Miliaria. Synochus with anxiety, frequent ſighing, fœtid ſweat, and points on the ſkin. On an uncertain day of the diſeaſe, break out red, ſmall, diſtinct papulæ, ſpread over the whole body as well as the face; the apices of which, after one or two days, become very ſmall white puſtules, remaining for a ſhort time.

Genus XXXII. Scarlatina. A contagious Synocha. On the fourth day of the diſeaſe the face ſwells a little; at the ſame time an univerſal redneſs occupies the ſkin in large ſpots, at length running together; after three days going off in branny ſcales; frequently ſucceeded by anaſarca. The ſpecies are,

I. Scarlatina (*ſimplex*), not accompanied with cynanche.

II. Scarlatina (*cynanchica*), with an ulcerous cynanche.

Genus XXXIII. Urticaria. An amphemerina fever. On the ſecond day of the diſeaſe, red ſpots reſembling the ſtinging of nettles, almoſt vaniſhing during the day, but returning in the evening with the fever, and after a few days going off altogether in very ſmall ſcales.

Genus XXXIV. Pemphigus. A contagious typhus. On the firſt, ſecond, or third day of the diſeaſe, bliſters break out in ſeveral parts of the body, of the bigneſs of a bean, remaining for many days, and at laſt pouring out a thin ichor.

Genus XXXV. Aphtha. Synochus; the tongue ſomewhat ſwelled and of a livid colour, as well as the fauces; eſchars firſt appearing in the fauces, but at length

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length occupying the whole internal part of the mouth, of a white colour, sometimes distinct, often running together; quickly growing again when taken off; and remaining for an uncertain time.

The species are, 1. Idiophatic. 2 Symptomatic.

Order IV. Hæmorrhagiæ. Pyrexia, with a profusion of blood, without any external violence: the blood drawn from a vein hath the same appearance as in phlegmasiæ.

Genus XXXVI. Epistaxis. Pain or weight of the head, redness of the face: a profusion of blood from the nose.

I. Idiopathic.

Varying according to the time of life.

1. Epistaxis of young people, with symptoms of an arterious plethora.

2. Epistaxis of old people, with symptoms of a venous plethora.

II. Symptomatic.

1. From internal causes.

2. From external causes.

Genus XXXVII. Hæmoptysis. Redness of the cheeks; a sensation of uneasiness, or pain, and sometimes of heat in the breast; difficulty of breathing; tickling of the fauces, either a severe or less violent cough, bringing up florid and frequently frothy blood.

The Idiopathic species are,

1. Hæmoptysis (*plethorica*), without any external violence, and without being preceded by any cough or suppression of any customary evacuation.

2. Hæmoptysis (*violenta*), from external violence applied.

3. Hæmoptysis (*phthisica*), after a long continued cough, with a leanness and debility.

4. Hæmoptysis (*calculosa*), in which some calculous molecules, for the most part of a calcareous nature, are thrown up.

5. Hæmoptysis (*vicaria*), after the suppression of a customary evacuation.

Besides these, there are a number of symptomatic species mentioned by different authors. The consequence of an hæmoptysis is, a

Phthisis. A wasting and debility of the body, with a cough, hectic fever, and for the most part a purulent expectoration. The species are,

I. An incipient phthisis, without any expectoration of pus.

II. A confirmed phthisis, with an expectoration of pus.

Both species vary, 1. As to their remote cause. 2. As to the origin of the purulent matter.

Genus XXXVIII. Hæmorrhois. Weight and pain of the head; vertigo; pain of the loins; pain of the anus; livid painful tubercles, from which for the most part blood flows out; which sometimes also drops out of the anus, without any apparent tumor. The species are,

1. Hæmorrhois (*tumens*), external from mariscæ.

Varying.

A. Bloody.

B. Mucous.

2. Hæmorrhois (*procidens*), external from a *procidentia ani*.

3. Hæmorrhois (*fluens*), internal, without any swelling, or *procidentia ani*.

4. Hæmorrhois (*cæca*), with pain and swelling of the anus, without any profusion of blood.

Genus XXXIX. Menorrhagia. Pains of the back, belly, and loins, like those of child-birth; an unusually copious flux of the menses or blood from the vagina. The species are,

1. Menorrhagia (*rubra*), bloody in women neither with child nor in child-birth.

2. Menorrhagia (*abortus*), bloody in women with child.

3. Menorrhagia (*lochiales*), bloody in women after delivery.

4. Menorrhagia (*vitiorum*) bloody from some local disease.

5. Menorrhagia (*alba*), serous, without any local disease, in women not with child.

6. Menorrhagia (*Nabothi*), serous in women with child.

Order V. Profluvia. Pyrexia, with an increased secretion, naturally not bloody.

Genus XL. Catarrhus. Pyrexia frequently contagious; an increased excretion of mucus, at least efforts to excrete it.

The species are for the most part symptomatic.

1. From cold.

2. From contagion.

Genus XLI. Dysenteria. Contagious pyrexia; frequent mucus or bloody stools, while the alvine feces are for the most part retained; gripes; tenesmus.

Varying:

1. Accompanied with worms.

2. With the excretion of small fleshy or sebaceous bodies.

3. With an intermittent fever.

4. Without blood.

5. With a miliary fever.

CLASS II. Neurosis. An injury of the sense and motion, without an idiopathic pyrexia or any local affection.

Order I. Comata. A diminution of voluntary motion, with sleep, or a deprivation of the senses.

Genus XLII. Apoplexia. Almost all voluntary motion diminished, with sleep more or less profound; the motion of the heart and arteries remaining.

The idiopathic species are,

1. Apoplexia (*sanguinea*) with symptoms of universal plethora, especially of the head.

2. Apoplexia (*serosa*) with a leucophlegmatia over the whole body, especially in old people.

3. Apoplexia (*hydrocephalica*) coming on by degrees; affecting infants, or those below the age of puberty, first with lassitude, a slight fever and pain of the head, then with slowness of the pulse, dilatation of the pupil of the eye, and drowsiness.

4. Apoplexia (*atrabiliaria*) taking place in those of a melancholic constitution.

5. Apoplexia (*traumatica*) from some external injury mechanically applied to the head.

6. Apoplexia (*venenata*) from powerful sedatives taken internally or applied externally.

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7. Apoplexia *(mentalis)* from a passion of the mind.
8. Apoplexia *(cataleptica)* the muscles remaining contractile, by external motion of the limbs.
9. Apoplexia *(suffocata)* from some external suffocating power.

The apoplexia is frequently symptomatic.

1 Of an intermitting fever. 2 Continued fever. 3 Phlegmasia. 4 Exanthema. 5 Hysteria. 6 Epilepsy. 7 Podagra. 8 worms. 9 Ischuria. 10 Scurvy.

Genus XLIII. Paralysis. Only some of the voluntary motions diminished, frequently with sleep.

The idiopathic species are,

1 Paralysis *(partialis)* of some particular muscles only.

2. Paralysis *(hemiplegica)* of one side of the body.

Varying according to the constitution of the body.

a. Hemiplegia in a plethoric habit.

b. In a leucophlegmatic habit.

3. Paralysis *(paraplegica)* of one half of the body taken transversely.

4. Paralysis *(venenata)* from sedative powers applied either internally or externally.

A symptom either of an Asthenia or Palsy is,

Tremor; an alternate motion of a limb by frequent strokes and intervals.

The species are, 1 Asthenic. 2 Paralytic. 3 Convulsive.

Order II. Adynamiæ. A diminution of the involuntary motions whether vital or natural.

Genus XLIV. Syncope; a diminution, or even a total stoppage, of the motion of the heart for a little.

I. Idiopathic.

1. Syncope *(cardiaca)* returning frequently without any manifest cause, with violent palpitations of the heart during the intervals.—From a fault of the heart or neighbouring vessels.

2. Syncope *(occasionalis)* arising from some evident cause.—From an affection of the whole system.

II. Symptomatic; or symptoms of diseases either of the whole system, or of other parts besides the heart.

Genus XLV. Dyspepsia. Anorexia, nausea, vomiting, inflation, belching, rumination, cardialgia, gastrodynia, more or fewer of those symptoms at least concurring: from the most part with a constipation of the belly, and without any other disease either of the stomach itself or of other parts.

I. Idiopathic.

II. Symptomatic.

1. From a disease of the stomach itself.

2. From a disease of other parts, or of the whole body.

Genus XLVI. Hypochondriasis. Dyspepsia, with languor, sadness and fear without any adequate causes, in a melancholy temperament.

Genus XLVII. Chlorosis. Dyspepsia, or a desire of something not used as food; a pale or discoloured complexion; the veins not well filled; a soft tumor of the whole body; asthenia; palpitation; suppression of the menses.

Order III. Spasmi. Irregular motions of the muscles or muscular fibres.

Sect. I. *In the animal functions.*

Genus XLVIII. Tetanus;—a spastic rigidity of almost the whole body.

Varying according to the remote cause, as it arises either from something internal, from cold, or from a wound. It varies likewise from whatever cause it may arise, according to the part of the body affected.

Genus XLIX. Trismus. A spastic rigidity of the lower jaw.—The species are,

1. Trismus *(nascentium)*, seizing infants under two months old.

2. Trismus *(traumaticus)*, seizing people of all ages either from a wound or cold.

Genus L. Convulsio.—An irregular clonic contraction of the muscles without sleep.

I. Idiopathic.

II. Symptomatic.

Genus LI. Chorea, attacking those who have not yet arrived at puberty, most commonly within the 10th or 14th year, with convulsive motions for the most part of one side in attempting the voluntary motion of the hands and arms, resembling the gesticulations of mountebanks; in walking, rather dragging one of their feet after them than lifting it.

Genus LII. Raphania. A spastic contraction of the joints, with a convulsive agitation, and most violent periodical pain.

Genus LIII. Epilepsia A convulsion of the muscles, with sleep.

The idiopathic species are,

1. Epilepsia *(cerebralis)*, suddenly attacking without any manifest cause, without any sense of uneasiness preceding, excepting perhaps a slight vertigo or scotomia.

2. Epilepsia *(sympathetica)*, without any manifest cause, but preceded by the sensation of a kind of air rising from a certain part of the body towards the head.

3. Epilepsia *(occasionalis)*, arising from a manifest irritation, and ceasing on the removal of that irritation.

Varying according to the difference of the irritating matter. And thus it may arise,

From injuries of the head; pain; worms; poison; from the repulsion of the itch, or an effusion of any other acrid humour; from crudities in the stomach; from passions of the mind; from an immoderate hemorrhagy; or from debility,

Sect. II. *In the vital functions.*

In the action of the heart.

Genus LIV. Palpitatio. A violent and irregular motion of the heart.

In the action of the lungs.

Genus LV. Asthma. A difficulty of breathing returning by intervals, with a sense of straitness in the breast, and a noisy respiration with hissing. In the beginning of the paroxysm there is either no cough at all, or coughing is difficult; but towards the end the cough becomes free, frequently with a copious spitting of mucus.—The idopathic species are,

1. Asthma *(spontaneum)*, without any manifest cause or other concomitant disease.

2. Asthma *(exanthematicum)*, from the repulsion of the itch or other acrid effusion.

3. Asthma *(plethoricum)*, from the suppression of some

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some customary sanguineous evacuation, or from a spontaneous plethora.

Genus LVI. Dyspnœa. A continual difficulty of breathing, without any sense of straitness, but rather of fullness and infarction in the breast; a frequent cough throughout the whole course of the disease.

The idiopathic species are,

1. Dyspnœa *(catarrhalis)*, with a frequent cough, bringing up plenty of viscid mucus.

2. Dyspnœa *(sicca)*, with a cough for the most part dry.

3. Dyspnœa *(aërea)*, increased by the least change of weather

4. Dyspnœa *(terrea)*, bringing up with the cough an earthy or calculous matter.

5. Dyspnœa *(aquosa)*. with scanty urine and œdematous feet; without any fluctuation in the breast, or other signs of an hydrothorax.

6. Dyspnœa *(pinquedinosa)*, in very fat people.

7. Dyspnœa *(thoracica)*, from an injury done to the parts surrounding the thorax, or from some bad conformation of them.

8. Dyspnœa *(extrinseca)*, from evident external causes.

The symptomatic species of dyspnœa are symptoms,

1. Of diseases of the heart or large vessels.

2. Of a swelling in the abdomen.

3. Of various diseases.

Genus LVII. Pertussis. A contagious disease; convulsive strangulating cough reiterated with noisy inspiration; frequent vomiting.

Sect. III. *In the natural functions.*

Genus LVIII. Pyrosis. A burning pain in the epigastrium, with plenty of aqueous humour, for the most part insipid, but sometimes acrid, belched up.

Genus LIX. Colica. Pain of the belly, especially twisting round the navel; vomiting; a constipation.

The idiopathic species are,

1. Colica *(spasmodica)*, with retraction of the navel, and spasms of the abdominal muscles.

Varying, by reason of some symptoms supperadded. Hence,

a, Colica, with vomiting of excrements, or of matters injected by the anus.

b, Colica, with inflammation supervening.

2. Colica *(pictonum)*, preceded by a sense of weight or uneasiness in the belly, especially about the navel; then comes on the colic pain, at first slight and interrupted, chiefly augmented after meals: at length more severe and almost continual, with pains of the arms and back, at last ending in a palsy.

Varying according to the nature of the remote cause; and hence,

a, From metallic poison.

b, From acids taken inwardly.

c, From cold.

d, From a contusion of the back.

3. Colica *(stercorea)*, in people subject to costiveness.

4. Colica *(accidentalis)*, from acrid matter taken inwardly.

5. Colica *(meconialis)*, in new-born children from a retention of the meconium.

6. Colic *(callosa)*, with a sensation of stricture in some part of the intestine, and frequently of a collection of flatus with some pain before the constricted part; which flatus also passing through the part where the stricture is felt, gradually vanishes: the belly slow, and at last passing only a few liquid fæces.

7. Colica *(calculosa)*, with a fixed hardness in some part of the abdomen, and calculi sometimes passing by the anus.

Genus LX. Cholera. A vomiting of bilious matter, and likewise a frequent excretion of the same by stool; anxiety; gripes; spasms in the calves of the legs.

I. Idiopathic.

1. Cholera *(spontanea)*, arising in a warm season, without any manifest cause.

2. Cholera *(accidentalis)*, from acrid matters taken inwardly.

II. Symptomatic.

Genus LXI. Diarrhœa. Frequent stools; the disease not infectious; no primary pyrexia.

I. Idiopathic

1. Diarrhœa *(crapulosa)*, in which the excrements are voided in greater quantity than natural.

2. Diarrhœa *(biliosa)*, in which yellow feces are voided in great quantity.

3. Diarrhœa *(mucosa)*, in which either from acrid substances taken inwardly, or from cold, especially applied to the feet, a great quantity of mucus is voided.

4. Diarrhœa *(cœliaca)*, in which a milky humour of the nature of chyle is passed.

5. Diarrhœa *(lienteria)*, in which the aliments are discharged with little alteration soon after eating.

6. Diarrhœa *(hepatirrhœa)*, in which a bloody serous matter is discharged without pain.

II. Symptomatic.

Genus LXII. Diabetes. A chronical profusion of urine, for the most part preternatural, and in immoderate quantity.

I. Idiopathic.

1. Diabetes *(mellitus)*, with urine of the smell, colour, and taste of honey.

2. Diabetes *(insipidus)*, with limpid but not sweet, urine.

II. Symptomatic.

Genus LXIII. Hysteria. Rumbling of the bowels; a sensation as of a globe turning itself in the belly, ascending to the stomach and fauces, and there threatening suffocation; sleep; convulsions; a great quantity of limpid urine: the mind involuntarily fickle and mutable.

The following are by Sauvages reckoned distinct idiopathic species; but, by Dr Cullen, only varieties of the same species.

A, From a retention of the menses.

B, From a menorrhagia cruenta.

C, From a menorrhagia serosa, or fluor albus.

D, From an obstruction of the viscera.

E, From a fault of the stomach.

F, From too great salacity.

Genus LXIV. Hydrophobia. A dislike and horror at any kind of drink, and occasioning a convulsion of the pharynx; induced, for the most part, by the bite of a mad animal. The species are.

1. Hydro-

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I. Hydrophobia (*rabiosa*), with a desire of biting the bystanders; occasioned by the bite of a mad animal.

II. Hydrophobia (*simplex*), without madness, or any desire of biting.

Order IV. Vesaniæ. Disorders of the judgment, without any pyrexia or coma.

Genus LXV. Amentia; an imbecility of judgment, by which people either do not perceive, or do not remember, the relations of things. The species are,

I. Amentia (*congenita*), continuing from a person's birth.

II. Amentia (*senilis*), from the diminution of the perceptions and memory through extreme old age.

III. Amentia (*acquisita*), recurring in people formerly of a sound mind, from evident external causes.

Genus LXVI. Melancholia; a partial madness, without dyspepsia.

Varying according to the different subjects concerning which the person raves; and thus it is,

1. With an imagination in the patient concerning his body being in a dangerous condition, from slight causes; or that his affairs are in a desperate state.

2. with an imagination concerning a prosperous state of affairs.

3. With violent love, without satyriasis or nymphomania.

4. With a superstitious fear of a future state.

5. With an aversion from motion and all the offices of life.

6. With restlessness, and an impatience of any situation whatever.

7. With a weariness of life.

8. With a deception concerning the nature of the patient's species.

Dr Cullen thinks that there is no such disease as that called *dæmonomania*, and that the diseases mentioned by Sauvages under that title are either,

1. Species of melancholy or mania; or

2. Of some disease by the spectators falsly ascribed to the influence of an evil spirit; or

3. Of a disease entirely feigned; or

4. Of a disease partly true and partly feigned.

Genus LXVII. Mania; universal madness.

1. Mania (*mentalis*), arising entirely from passions of the mind.

2. Mania (*corporea*), from an evident disease of the body.

Varying according to the different diseases of the body.

3. Mania (*obscura*), without any passion of mind or evident disease of the body preceding.

The symptomatic species of mania are,

1. Paraphrosyne from poisons.

2. Paraphrosyne from passion.

3. Paraphrosyne febrilis.

Genus LXVIII. Oneirodynia. A violent and troublesome imagination in time of sleep.

1. Oneirodynia (*activa*), exciting to walking and various motions.

2. Oneirodynia (*gravans*), from a sense of some weight incumbent, and pressing on the breast especially.

CLASS III. Cachexiæ; a depraved habit of the whole or greatest part of the body, without primary pyrexia or neurosis.

Order I. Marcores; a wasting of the whole body.

Genus LXIX. Tabes, Leanness, asthenia, hectic pyrexia. The species are,

1. Tabes (*purulenta*), from an external or internal ulcer, or from a vomica

Varying in its situation: hence,

2. Tabes (*scrophulosa*), in scrophulous constitutions

3. Tabes (*venenata*), from poison taken inwardly.

Genus LXX. Atrophia. Leanness and asthenia, without hectic pyrexia. The species are.

1. Atrophia (*inanitorum*), from too great evacuation.

2. Atrophia (*famelicorum*), from a deficiency of nourishment.

3. Atrophia (*cacochymia*), from corrupted nourishment.

4. Atrophia (*debilium*), from the function of nutrition being depraved, without any extraordinary evacuation or cacochymia having preceded.

Order II. Intumescentiæ. An external tumor of the whole or greatest part of the body.

Sect I. *Adiposæ*.

Genus LXXI. Polysarcia; a troublesome swelling of the body from fat.

Sect. II. *Flatuosæ*.

Genus LXXII. Pneumatosis; a tense elastic swelling of the body, crackling under the hand. The species are,

1. Pneumatosis (*spontanea*), without any manifest cause.

2. Pneumatosis (*traumatica*), from a wound in the breast.

3. Pneumatosis (*venenata*), from poison injected or applied.

4. Pneumatosis (*hysterica*), with hysteria.

Genus LXXIII. Tympanites; a tense, elastic, sonorous swelling of the abdomen; costiveness; a decay of the other parts. The species are,

1. Tympanites (*intestinalis*), with a tumor of the abdomen frequently unequal, and with a frequent evacuation of air relieving the tension and pain.

2. Tympanites (*abdominalis*), with a more evident noise, a more equable tumor, and a less frequent emission of flatus, which also gives less relief.

Genus LXXIV. Physometra; a slight elastic swelling in the epigastrium, having the figure and situation of the uterus.

Sect. III *Aquosæ or Hydropes*.

Genus LXXV. Anasarca. A soft, inelastic swelling of the whole body, or some part of it. The species are,

1. Anasarca (*serosa*), from a retention of serum on account of the suppression of the usual evacuations, or from an increase of the serum on account of too great a quantity of water taken inwardly.

2. Anasarca. (*oppilata*), from a compression of the veins.

3. Anasarca (*exanthematica*), arising after exanthemata, especially after the erysipelas.

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4. Anasarca (*anæmia*), from the thinness of the blood produced by hemorrhagy.

5. Anasarca (*debilium*), in weak people after long diseases, or from other causes.

Genus LXXVI. Hydrocephalus. A soft inelastic swelling of the head, with the sutures of the cranium opened.

Genus LXXVII. Hydrorachitis. A soft, slender tumor above the vertebræ of the loins; the vertebræ gaping from each other.

Genus LXXVIII. Hydrothorax. Dyspnœa; paleness of the face; œdematous swellings of the feet; scanty urine; lying down difficult; a sudden and spontaneous waking out of sleep, with palpitation; water fluctuating in the breast.

Genus LXXIX. Ascites. A tense, scarce elastic, but fluctuating swelling of the abdomen. The species are,

1. Ascites (*abdominalis*), with an equal swelling of the whole abdomen, and with a fluctuation sufficiently evident.

Varying according to the cause.

A, From an obstruction of the viscera.

B, From debility.

C, From a thinness of the blood.

2, Ascites (*saccatus*), with a swelling of the abdomen, in the beginning at least, partial, and with a less evident fluctuation.

Genus LXXX. Hydrometra. A swelling of the hypogastrium in women, gradually increasing, keeping the shape of the uterus, yielding to pressure, and fluctuating; without ischuria or pregnancy.

Genus LXXXI. Hydrocele. A swelling of the scrotum, not painful: increasing by degrees, soft, fluctuating, and pellucid.

Sect. IV. *Solidæ*.

Genus LXXXII. Physconia. A swelling chiefly occupying a certain part of the abdomen, gradually increasing, and neither sonorous nor fluctuating. The species are.

Physconia hepatica.
Physconia splenica.
Physconia renalis.
Physconia uterina.
Physconia ab ovario,
Physconia mesenterica.
Physconia intestinalis.
Physconia omentalis.
Physconia polysplachna.
Physconia visceralis.
Physconia externa lupialis.
Physconia externa scirrhodea.
Physconia externa hydatidosa.
Physconia ab adipe subcutaneo.
Physconia ab excrescentia.

Genus LXXXIII. Rachitis. A large head, swelling most in the forepart, the ribs depressed; abdomen swelled, with a decay of the other parts.

Varying.

1. Simple, without any other disease.

2. Joined with other diseases.

Order III. Impetigines. Cachexies chiefly deforming the skin and external parts of the body.

Genus LXXXIV. Scrophula. Swellings of the conglobate glands, especially upon the neck; swelling of the upper lip and support of the nose; the face florid, skin thin, abdomen swelled. The species are,

1. Scrophula (*vulgaris*), simple, external, and permanent.

2. Scrophula (*mesenterica*), simple, internal, with paleness of the face, want of appetite, swelling of the abdomen, and unusual fetor of the excrements.

3. Scrophula (*fugax*), most simple, appearing only about the neck; for the most part proceeding from the resorption of the matter of ulcers in the head.

4. Scrophula (*Americana*), joined with the yaws.

Genus LXXXV. Syphilis. A contagious disease, after impure venery, and a disorder of the genitals; ulcers of the tonsils; of the skin, especially about the margin of the hair; corymbose papulæ, ending in crusts and crusty ulcers; pains of the bones; exostoses.

Genus LXXXVI. Scorbutus; in cold countries, attacking after putrescent diet, especially such as is salt and of the animal kind, where no supply of fresh vegetables is to be had; asthenia; stomacace; spots of different colours on the skin, for the most part livid, and appearing chiefly among the roots of the hair.

Varying in degree.

a, Scorbutus incipiens.

b, Scorbutus crescens.

c, Scorbutus inveteratus.

Varying also in symptoms.

d, Scorbutus lividus.

e, Scorbutus petechialis.

f, Scorbutus pallidus.

g, Scorbutus ruber.

h, Scorbutus calidus.

Genus LXXXVII. Elephantiasis; a contagious disease; thick, wrinkled, rough, unctuous skin, destitute of hairs, anæsthesia in the extremities, the face deformed with pimples, the voice hoarse and nasal.

Genus LXXXVIII. Lepra; the skin rough, with white, branny, and chopped eschars, sometimes moist beneath, with itching.

Genus LXXXIX. Framboesia; swellings resembling fungi, or the fruit of the mulberry or raspberry, growing on various parts of the skin.

Genus XC. Trichoma; a contagious disease; the hairs thicker than usual, and twisted into inextricable knots and cords.

Genus XCI. Icterus; yellowness of the skin and eyes; white fæces; urine of a dark red, tinging what is put into it of a clay colour.

The idiopathic species are,

1. Icterus (*calculosus*), with acute pain in the epigastric region, increasing after meals; biliary concretions voided by stool.

2. Icterus (*spasmodicus*), without pain, after spasmodic diseases and passions of the mind.

3. Icterus (*hepaticus*), without pain, after diseases of the liver.

4. Icterus (*gravidarum*), arising during the time of pregnancy, and going off after delivery.

5. Icterus (*infantum*), coming on in infants a few days after birth.

CLASS

General Arrangement of Diseases.

CLASS IV. Locales. An affection of some part, but not of the whole body.

Order I. Dysethesiæ. The senses depraved or destroyed, from a disease of the external organs.

Genus XCII. Caligo. The sight impaired or totally destroyed, on account of some opaque substance interposed between the objects and the retina, inherent in the eye itself or the eye-lids. The species are,

1. Caligo *(lentis)*, occasioned by an opaque spot behind the pupil.

2. Caligo *(corneæ)*, from an opacity of the cornea.

3. Caligo *(pupillæ)*, from an obstruction of the pupil.

Varying according to the different causes from which it proceeds.

4. Caligo *(humorum,)* from a disease or defect of the aqueous humour.

Varying according to the different state of the humour.

5. Caligo *(palpebrarum)*, from a disease inherent in the eye-lids.

Varying according to the nature of the disease in the eye-lids.

Genus XCIII. Amaurosis. The sight diminished, or totally abolished, without any evident disease of the eye; the pupil for the most part remaining dilated and immoveable. The species are,

1. Amaurosis (*compressionis*), after the causes and attended with the symptoms of congestion in the brain.

Varying according to the nature of the remote cause.

2. Amaurosis (*atonica*), after the causes and accompanied with symptoms of debility.

3. Amaurosis *(spasmodica)*, after the causes and with the signs of spasm.

4. Amaurosis (*venenata*), from poison taken into the body or applied outwardly to it.

Genus XCIV. Dysopia. A depravation of the sight, so that objects cannot be distinctly perceived, except at a certain distance, and in a certain situation. The species are,

1. Dysophia (*tenebrarum*), in which objects are not seen unless they be placed in a strong light.

2. Dysopia (*luminis*), in which objects are not distinctly seen unless by a weak light.

3. Dysopia (*distantorum*), in which distant objects are not perceived.

4. Dysopia (*proximorum*), in which the nearest objects are not perceived.

5. Dysopia (*lateralis*), in which objects are not perceived unless placed in an oblique posture.

Genus XCV. Pseudoblepsis; when the sight is diseased in such a manner that the person imagines he sees things which really do not exist, or sees things which do exist after some other manner than they really are. The species are,

1. Pseudoblepsis (*imaginaria*), in which the person imagines he sees things which really do not exist.

Varying according to the nature of the imagination.

2. Pseudoblepsis (*mutans*), in which objects really existing appear somehow changed.

Varying according to the change perceived in the objects, and according to the remote cause.

Genus XCVI. Dysecœa. A dimunition or total abolition of the sense of hearing. The species are,

1. Dysecœa *(organica)*, from a disease in the organs transmitting sounds to the internal ear.

Varying according to the nature of the disease of the part affected.

2. Dysecœa (*atonica*), without an evident disease of the organs transmitting the sounds.

Varying according to the nature of the cause.

Genus XCVII. Paracusis; a depravation of the hearing. The species are,

1. Paracusis (*imperfecta*), in which though sounds coming from external objects are heard, yet it is neither distinctly nor in the usual manner.

Varying.

a, With a dulness of hearing.

b, With an hearing too acute and sensible.

c, When a single external sound is doubled by some internal causes.

d, When the sounds which a person desires to hear are not perceived, unless some other violent sound is raised at the same time.

2. Paracusis (*imaginaria*), in which sounds not existing externally are excited from internal causes.

Varying according to the nature of the sound perceived, and according to the nature of the remote cause.

Genus XCVIII. Anosmia; a dimunition or abolition of the sense of smell. The species are,

1. Anosmia; (*organica*), from a disease in the membrane lining the internal parts of the nostrils.

Varying according to the nature of the disease.

2. Anosmia (*atonica*), without any evident disease of the membrane of the nose.

Genus XCIX. Agheustia; a dimunition or abolition of the sense of taste.

1. Agheustia (*organica*), from a disease of the membrane of the tongue, keeping off from the nerves those substances which ought to produce taste.

2. Agheustia (*atonica*), without any evident disease of the tongue.

Genus C. Anæsthesia; a dimunition or abolition of the sense of feeling. The species from Sauvages, adopted by Dr Cullen, are,

1. Anæsthesia a spina bifida.
2. Anæsthesia plethorica.
3. Anæsthesia nascentium.
4. Anæsthesia melancholica.

Order II. Dysorexia; error or defect of appetite.

Sect. I. Appetitus erronei.

Genus CI. Bulimia: a desire for food in greater quantities than can be digested.

The idiopathic species are,

1. Bulimia (*helluonum*), an unusual appetite for food, without any disease of the stomach.

2. Bulimia (*syncopalis*), a frequent desire of meat, on account of a sensation of hunger threatening syncope.

5. Bulimia (*emetica*), an appetite for a great quantity of meat, which is thrown up immediately after it is taken.

Genus CII. Polydipsia; an appetite for an unusual quantity of drink.

The polydipsia is almost always symptomatic, and varies

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varies only according to the nature of the disease which accompanies it.

Genus CIII. Pica; a desire of swallowing substances not used as food.

Genus CIV. Satyriasis: an unbounded desire of venery in men. The species are,

1. Satyriasis (*juvenilis*), an unbounded desire of venery, the body at the same time being little disordered.

2. Satyriasis (*furens*), a vehement desire of venery, with a great disorder of the body at the same time.

Genus CV. Nymphomania; an unbounded desire of venery in women.

Varying in degree.

Genus CVI. Nostalgia; a violent desire in those who are absent from their country of revisiting it.

1. Nostalgia (*simplex*), without any other disease.

2. Nostalgia (*complicata*), accompanied with other diseases.

Sect. II. Appetitus deficientes.

Genus CVII. Anorexia. Want of appetite for food. Always symptomatic.

1. Anorexia (*humoralis*), from some humour loading the stomach.

2. Anorexia (*atonica*), from the tone of the fibres of the stomach being lost.

Genus CVIII. Adipsia; a want of thirst. Always a symptom of some disease affecting the sensorium commune.

Genus CIX. Anaphrodisia; want of desire for, or impotence to, venery.

The true species are,

1. Anaphrodisia paralytica.

2. Anaphrodisia gonorrhoica.

The false ones are,

1. Anaphrodisia a mariscis.

2. Anaphrodisia ab urethræ vitio.

Order III. Dyscinesiæ. An impediment, or depravation of motion from a disorder of the organs.

Genus CX. Aphonia; a total suppression of voice without coma or syncope. The species are,

1. Aphonia (*gutturalis*), from the fauces or glottis being swelled.

2. Aphonia (*trachealis*), from a compression of the trachea.

3. Aphonia (*atonica*), from the nerves of the larynx being cut.

Genus CXI. Mutitas; want of power to pronounce words. The species are,

1. Mutitas (*organica*), from the tongue being cut out or destroyed.

2. Mutitas (*atonica*), from the injuries done to the nerves of the tongue.

3. Mutitas (*surdorum*), from people being born deaf, or the hearing being destroyed during childhood.

Genus CXII. Paraphonia a depraved sound of the voice. The species are,

1. Paraphonia (*puberum*), in which, about the time of puberty, the voice from being acute and sweet, becomes more grave and harsh.

2. Paraphonia (*rauca*), in which, by reason of the dryness or flaccid tumor of the fauces, the voice becomes rough and hoarse.

2. Paraphonia (*resonans*), in which, by reason of an obstruction in the nostrils, the voice becomes hoarse, with a sound hissing through the nostrils.

4. Paraphonia (*palatina*), in which, on account of a defect or division of the uvula, for the most part with an hare-lip, the voice becomes obscure, hoarse, and unpleasant.

5. Paraphonia (*clangens*), in which the voice is changed to one acute, shrill, and small.

6. Paraphonia (*comatosa*, in which, from a relaxation of the velum palati and glottis, a sound is produced during inspiration.

Genus CXIII. Psellismus; a defect in the articulation of words. The species are,

1. Psellismus (*hæsitans*), in which the words, especially the first ones of a discourse, are not easily pronounced, and not without a frequent repetition of the first syllable.

2. Psellismus (*ringens*), in which the sound of the letter R is always aspirated, and, as it were, doubled.

3. Psellismus (*lallans*), in which the sound of the letter L becomes more liquid, or is pronounced instead of R.

4. Psellismus (*emolliens*), in which the hard letters are changed into the softer ones, and thus the letter S is much used.

5. Psellismus (*balbutiens*), in which, by reason of the tongue being large, or swelled, the labial letters are better heard, and often pronounced instead of others.

6. Psellismus (*acheilos*), in which the labial letters cannot be pronounced at all, or with difficulty.

7. Psellismus (*logostomatum*), in which, on account of the division of the palate, the guttural letters are less perfectly pronounced.

Genus CXIV. Strabismus, the optic axes of the eyes not converging. The species are,

1. Strabismus (*habitualis*), from a bad custom of using only one eye.

2. Strabismus (*commodus*), from the greater debility or mobility of one eye above the other; so that both eyes cannot be conveniently used.

3. Strabismus (*necessarius*), from a change in the situation or shape of the parts of the eye.

Genus CXV. Contractura; a long-continued and rigid contraction of one or more limbs. The species are,

1. Contractura (*primaria*), from the muscles becoming contracted and rigid.

a, From the muscles becoming rigid by inflammation.

b, From muscles becoming rigid by spasm.

c, From muscles contracted by reason of their antagonists having become paralytic.

d, From muscles contracted by an irritating acrimony.

2. Contractura (*articularis*), from stiff joints.

Order IV. Apocenoses. A flux either of blood or some other humour flowing more plentifully than usual, without pyrexia, or an increased impulse of fluids.

Genus CXVI. Profusio; a flux of blood.

Genus CXVII. Ephidrosis; a preternatural evacuation of sweat.

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Symptomatic ephidroses vary according to the nature of the diseases which they accompany, the different nature of the sweat itself, and sometimes the different parts of the body which sweats most.

Genus CXVIII. Epiphora; a flux of the lacrymal humour.

Genus CXIX. Ptyalismus; a flux of saliva.

Genus CXX. Enuresis; an involuntary flux of urine without pain. The species are,

1. Enuresis (*atonica*), after diseases injuring the sphincter of the bladder.

2. Enuresis (*irritata*), from a compression or irritation of the bladder.

Genus CXXI. Gonorrhœa; a preternatural flux of humour from the urethra in men, with or without a desire of venery. The species are,

1. Gonorrhœa (*pura*) in which, without any impure venery having preceded, a humour resembling pus, without disuria or propensity to venery, flows from the urethra.

2. Gonorrhœa (*impura*), in which, after impure venery, an humour like pus flows from the urethra with dysuria. The consequence of this is,

Gonorrhœa (*mucosa*), in which, after an impure gonorrhœa, a mucous humour flows from the urethra with little or no dysuria.

3. Gonorrhœa (*laxorum*), in which an humour for the most part pellucid, without any erection of the penis, but with a propensity to venery, flows from the urethra while the person is awake.

4. Gonorrhœa (*dormientium*), in which the seminal liquor is thrown out, with erection and desire of venery, in those who are asleep and have lascivious dreams.

Order V. Epischeses; suppressions of evacuations.

Genus CXXII. Obstipatio; the stools either suppressed or slower than usual. The species are,

1. Obstipatio (*debilium*), in lax, weak and for the most part dyspeptic persons.

2. Obstipatio (*rigidorum*), in people whose fibres are rigid, and frequently of an hypochondriac disposition.

3. Obstipatio (*obstructorum*), with symptoms of the colica 1st, 2d, 4th, and 7th, abovementioned.

Genus CXXIII Ischuria; an absolute suppression of urine. The species are,

1. Ischuria (*renalis*), coming after a disease of the kidneys, with pain, or troublesome sense of weight in the region of the kidneys, and without any swelling of the hypogastrium, or desire of making water.

2. Ischuria (*ureterica*), coming after a disease of the kidneys, with a sense of pain or uneasiness in some part of the ureter, and without any tumor of the hypogastrium, or desire of making water.

3. Ischuria (*vesicalis*), with a swelling of the hypogastrium, pain at the neck of the bladder, and a frequent stimulus to make water.

4. Ischuria (*urethralis*), with a swelling of the hypogastrium, frequent stimulus to make water, and pain in some part of the urethra.

All these species are subdivided into many varieties, according to their different causes.

Genus CXXIV. Dysuria; a painful, and somehow impeded emission of urine. The species are,

1. Dysuria (*ardens*), with heat of water, without any manifest disorder of the bladder.

2. Dysuria (*spasmodica*), from a spasm communicated from the other parts to the bladder.

3. Dysuria (*compressionis*), from the neighbouring parts pressing upon the bladder.

4. Dysuria (*phlogistica*), from an inflammation of the neighbouring parts.

5. Dysuria (*irritata*), with signs of a stone in the bladder.

6. Dysuria (*mucosa*), with a copious excretion of mucus.

Genus CXXV. Dyspermatismus; a flow, impeded, and insufficient emission of semen in the venereal act. The species are.

1. Dyspermatismus (*urethralis*), from diseases of the urethra.

2. Dyspermatismus (*nodosus*), from knots on the cavernous bodies.

3. Dyspermatismus (*præputialis*), from too narrow an orifice of the prepuce.

4. Dyspermatismus (*mucosus*), from mucus infarcting the urethra.

5. Dyspermatismus (*hypertonicus*), from too strong an erection of the penis.

6. Dyspermatismus (*epilepticus*), from a spasmodic epilepsy happening during the time of coition.

7. Dyspermatismus (*apractodes*), from an imbecility of the parts of generation.

8. Dyspermatismus (*refluus*), in which there is no emission of semen, because it returns from the urethra into the bladder.

Genus CXXVI. Amenorrhœa. The menses either flowing more sparingly than usual, or not at all, at their usual time, without pregnancy. The species are,

1. Amenorrhœa (*emansionis*), In those arrived at puberty, in whom, after the usual time, the menses have not yet made their appearance, and many different morbid affections have taken place.

2. Amenorrhœa (*suppressionis*), in adults, in whom the menses which had already begun to flow are suppressed.

3. Amenorrhœa (*difficilis*), in which the menses flow sparingly, and with difficulty.

Order VI. Tumores; and increased magnitude of any part without phlogosis.

Genus CXXVII. Aneurisma; a soft tumour, with pulsation, above an artery,

Genus CXXVIII. Varix; a soft tumor, without pulsation, above a vein.

Genus CXXIX. Ecchymoma,, a diffused, and scarce eminent, livid tumor.

Genus CXXX. Scirrhus; an hard tumor of some part, generally of a gland, without pain, and difficultly brought to suppuration.

Genus CXXXI. Cancer. A painful tumor of a scirrhous nature, and degenerating into an ill-conditioned ulcer.

Genus CXXXII. Bubo; a suppurating tumor of a conglobate gland.

Genus CXXXIII. Sarcoma; a soft swelling, without pain.

Genus CXXXIV. Verruca; a harder scabrous swelling.

Genus. CXXXV. Clavus; a hard, lamellated thickness of the skin.

Genus

Febres.

Genus CXXXVI. Lupia. A moveable, ſoft tumour below the ſkin, without pain.

Genus CXXXVII. Ganglion. An harder moveable ſwelling, adhering to a tendon.

Genus CXXXVIII. Hydatis; a cuticular veſicle filled with aqueous humour.

Genus CXXXIX. Hydarthrus; a moſt painful ſwelling of the joints, chiefly of the knee, at firſt ſcarce elevated, of the ſame colour with the ſkin, diminiſhing the mobility.

Genus CXL. Exoſtoſis; a hard tumor adhering to a bone.

Order VII. Ectopiæ; tumors occaſioned by the removal of ſome part out of its proper ſituation.

Genus CXLI. Hernia; an ectopia of a ſoft part as yet covered with the ſkin and other integuments.

Genus CXLII. Prolapſus; a bare ectopia of ſome ſoft part.

Genus CXLIII. Luxatio; the removal of a bone from its place in the joints.

Order VIII. Dialyſes. A ſolution of continuity; manifeſt to the ſight or touch.

Genus CXLIV. Vulnus; a recent and bloody ſolution of the unity of ſome ſoft part by the motion of ſome hard body.

Genus CXLV. Ulcus. A purulent or ichorous ſolution of a ſoft part.

Genus CXLVI. Herpes; a great number of phlyctenæ or ſmall ulcers, gathering in cluſters, creeping, and obſtinate.

Genus CLXVII. Tinea; ſmall ulcers among the roots of the hair of the head, pouring out a humour which changes to a white friable ſcurf.

Genus CXLVIII. Pſora. Itchy puſtules and little ulcers of an infectious nature, chiefly infeſting the hands.

Genus CXLIX. Fractura; bones broken into large fragments.

Genus CL. Caries an exulceration of a bone.

Having thus preſented to our readers Dr Cullen's general ſyſtematic view of all the diſeaſes to which the human body is ſubjected, we come next to give a more particular account of the more important affections, treating of them in the order which Dr Cullen has arranged them.

Class I. PYREXIÆ, or the Febrile Diſeaſes.

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Order I. FEBRES, Or Fevers ſtrictly ſo called.

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Sauvag. Claſs II. *Vog.* Claſs I. *Sagar.* Claſs XII. Morbi Febriles Critici, *Lin.* Claſs II.

Sect. I. INTERMITTENTS.

Intermittentes of ſome authors; *Sauv.* Claſs II. Order III. *Lin.* Claſs II. Order II. *Vog.* Claſs I. Order I. *Sag.* Claſs XII. Order III.

The *remittentes* of others, *Sauv.* Claſs II. Order II. *Sag.* Claſs XII. Order II.

Exacerbantes, *Lin.* Claſs II. Order III.

Continuæ, *Vog.* Claſs I. Order II.

Tertiana.

Genus I. TERTIANA; the Tertian Fever.

(*Tertiana*, Sauv. G. 88. Lin. 16. Hoffm. Stahl. Cleghorn. Senac.)

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The *Genuine* Tertian.

(Tertiana legitima, *Senert. Hoffm. Cleghorn*, Minorc. *Sauv.* Sp. I.)

1. *Deſcription.* This diſeaſe, in its moſt regular form, conſiſts of repeated paroxiſms, returning every ſecond day, the patient during the intermediate period enjoying apparently a ſtate of good health. This is the moſt common form of ague, as it is commonly called in Britain. Each paroxyſm conſiſts of three parts, the cold, the hot, and the ſweating ſtages. The paroxyſm commonly begins with a remarkable ſhivering, increaſing frequently to a convulſive ſhaking of the limbs. The extremities are always cold, ſometimes remarkably ſo. The cold for the moſt part is firſt perceived about the lumbar regions, from thence aſcending along the ſpine turns toward the pit of the ſtomach. Sometimes it begins in the firſt joint of the fingers and tip of the noſe. Sometimes it attacks only a particular part of the body, as one of the arms, the ſide of the head, &c. This cold is often preceded by a heavy and ſleepy torpor, languor, and laſſitude, which we are partly to aſcribe to real weakneſs and partly to mere lazineſs. To theſe ſymptoms ſucceed yawning and ſtretching; after which the cold comes on as above deſcribed, not unfrequently with a pain of the back, and a troubleſome ſenſation of tenſion in the precordia and hypochondria. To this ſucceed nauſea and vomiting: and the more genuine the diſeaſe the more certainly does the vomiting come on; by which a great deal of tough mucous matter, and ſometimes bilious ſtuff or indigeſted food is evacuated during the firſt paroxyſms. In ſome there is only a violent ſtraining to vomit, without bringing up any thing: ſometimes, inſtead of theſe ſymptoms, a Diarrhœa occurs; and this chiefly in weak, phlegmatic, and aged people, or where an indigeſted mucous ſaburra has long remained in the primæ viæ

When theſe ſymptoms have continued for an hour or two, the cold begins to go off, and is ſucceeded by a laſſitude, languor, and flaccidity of the whole body, but chiefly in the limbs, with an uneaſy ſoreneſs as if the parts had been bruiſed; excepting in thoſe caſes where the nauſea continues for a longer time. After this langour, a heat comes on, the increaſe of which is generally ſlow, but ſometimes otherwiſe, with pain of the head, thirſt, and bitterneſs in the mouth. The pulſe is quick and unequal; ſometimes beating 130 ſtrokes in a minute. As ſoon as this heat has abated, a little moiſture or ſweat is obſerved to break forth; not always indeed in the firſt, but always in the ſucceeding paroxyſms, and the urine lets fall a quantity of lateritious ſediment. The whole paroxyſm is ſcarce ever over in leſs than ſix hours, more frequently eight, and in violent caſes extends to 12 hours; but that which exceeds 12 hours is to be reckoned a ſpurious kind, and approaching to the nature of continued fevers. All theſe ſymptoms, however, are repeated every ſecond day, in ſuch a manner that the patient is quite free from fever for at leaſt 24 hours. The paroxyſms return much about the ſame time, though ſometimes a little ſooner or later.

3. *Cauſes*

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3. *Causes of this disease, and persons subject to it.* The genuine tertian attacks men rather than women, young people rather than old; the latter being more subject to anomalous tertians. It likewise seizes the lusty and active, rather than the lazy and indolent. Those, however, who are apt to nauseate their meat, fall easily into a tertian fever. The cause, according to Dr Cullen, is the miasma of marshes, and that only. Other physicians have taken in many more causes, almost every thing indeed which debilitates the body: but the Doctor denies that any of these, though they may dispose the body for receiving the disease, or may augment it, can by any means produce it without the concurrence of the marsh miasma; and it cannot be denied, that it is a disease almost peculiar to marshy situations. Thus we find it very frequent in the fenny counties of Britain, although in other parts of the island it may be considered as a rare disease.

3. *Prognosis.* The genuine simple tertian, unless improper medicines be administered, is generally very easily cured; nay, the vulgar reckon it of such a salutary nature, that after it they imagine a person becomes more strong and healthy than before. Hippocrates has observed, that these fevers terminate of their own accord after seven or nine paroxysms. Juncker tells us, that it frequently terminates before the seventh paroxysm, but rarely before the fourth. He also denies that any thing critical is to be observed in its going off; but in this he differs from Vogel, who tells us, that the urine, for some days after the fever is quite gone off, appears slimy, and lets fall much sediment. The latter also informs us, that besides the common crisis by sweat and urine, the tertian hath one peculiar to itself, namely, dry scabby ulcers breaking out upon the lips. These sometimes appear about the third or fourth paroxysm; and then we may venture to foretel that the disease will go off spontaneously after the seventh. But though the disease be never dangerous, in cold climates at least, when properly treated; yet the improper use of hot and stimulating medicines may change it into a continued fever, more or less dangerous according to the quantity of medicines taken and the constitution of the patient; in which case the prognosis must be regulated by the particular symptoms which occur. In warm climates, however, the tertian fever may be considered as a much more dangerous disease; and unless the most powerful remedies be employed, the patient is in danger of falling a victim to every paroxysm.

A variety of theories have been proposed for explaining the phenomena of this affection; but we may easily assert, that every thing hitherto said upon the subject is highly unsatisfactory. For although it be now almost universally admitted, that this fever does arise from the effluvia of marshes, yet in what manner the action of those effluvia induces fever, and particularly why this fever returns in regular paroxysms, are questions with regard to which we are still totally in the dark. Dr Cullen, with much ingenuity, attempted to prove, that the remote causes of this; as well as of other fevers, operated by inducing a state of debility; that this debility gives rise to spasm, induces increased action, from which the phenomena are to be explained. But this theory is liable to no less numerous and unsurmountable objections than the exploded hypotheses which had before been proposed by others. For it is an undeniable truth, that debility often exists, even to the highest imaginable degree, without any fever; nay, that when fever has taken place, the debility is often much greater after it is entirely gone than at any period during its course. When spasm and increased action do take place, we have no reason to view them in any other light than merely as symptoms of the disease; and while they are often absent in this affection, they frequently occur in others where the sickness, anxiety, and other characterising symptoms of fever are entirely absent; and, upon the whole, a probable or rational theory of intermittents, as well as of other fevers, still remains to be discovered.

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Cure. The treatment of all genuine intermittents, whether *tertians*, quotidians, or quartans, being almost precisely the same, the general method of cure applicable to them all may be here given, to which it will be easy to refer when we come to describe the others.

In treating intermittent fevers, physicians have formed indications of cure according to their different theories. The followers of Boerhaave, Stahl, &c. who imagined that the disease proceeded from a lentor or other disorders in the blood, always thought it necessary to correct and evacuate these peccant humours by emetics and purgatives before they attempted to stop the disease by the peruvian bark or any other medicine. The bark, indeed, among some, seems to be held in very little estimation by them; since Vogel affirms, that this medicine, instead of deserving to have the preference of all other febrifuge medicines, ought rather to be ranked among the lowest of the whole; and for this reason he ascribes the cures, said to be obtained by the use of the Peruvian bark, entirely to nature.

According to Dr Cullen, the indications of cure in intermitting fevers may be reduced to the following.

1. In the time of intermission, to prevent the return of the paroxysms.

2. In the time of paroxysms, to conduct these in such a manner as to obtain a final solution of the disease.

3. To take off certain circumstances which might prevent the fulfilling of the two first indications.

The first indication may be answered in two ways. 1. By increasing the action of the heart and arteries some time before the period of accession, and supporting that increased action till the period of accession be over, and thus to prevent the recurrence of that atony and spasm of the extreme vessels, which he thinks give occasion to the recurrence of paroxisms. 2. By supporting the tone of the vessels, and thereby preventing atony and the consequent spasm, without increasing the action of the heart and arteries, the recurrence of paroxysms may be prevented.

The action of the heart and arteries may be increased, 1. By various stimulent remedies internally given or externally applied, and that without exciting sweat. 2. By the same remedies, or others, managed in such a manner as to excite sweating and to support that

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ſweating till the period of acceſſion be for ſome time paſt. 3. By emetics, ſupporting for the ſame time the tone and action of the extreme veſſels.

The tone of the extreme veſſels may be ſupported without increaſing the action of the heart and arteries, by various tonic medicines; as, 1. Aſtringents alone. 2. Bitters alone. 3. Aſtringents and bitters conjoined. 4. Aſtringents and aromatics conjoined. 5. Certain metallic tonics: and, 6. Opiates. A good deal of exerciſe, and as full a diet as the condition of the patient's appetite and digeſtion allow of will be proper during the time of intermiſſion, and may be conſidered as belonging to this head. Athough many particulars in this plan of cure are deduced from Dr Cullen's theory, yet there can be no doubt that the object chiefly to be aimed at is to employ ſuch remedies during the intermiſſions as will prevent a recurrence of the paroxyſm. Of all the remedies hitherto employed with this intention, the moſt celebrated, perhaps the moſt certainly effectual, is the Peruvian bark; or, to ſpeak more properly, the bark of the *Cinchona officinalis* of Linnæus. But it muſt be obſerved that good effects are only to be expected from this medicine when given in ſubſtance and in large quantity; and for its uſe the following rules or obſervations have been given.

1. The bark may with ſafety be employed at any period of intermitting fevers, providing that at the ſame time there be neither a phlogiſtic diatheſis prevailing in the ſyſtem, nor any conſiderable or fixed congeſtion preſent in the abdominal viſcera.

2. The proper time for exhibiting the bark in intermittent fevers is during the time of intermiſſion, and it is to be abſtained from in the time of paroxyſms.

3. In the caſe of genuine intermittents, while a due quantity of bark is employed, the exhibition of it ought to be brought as near to the time of acceſſion as the condition of the patient's ſtomach will allow.

4. In all caſes of intermittents it is not ſufficient that the recurrence of paroxyſms be ſtopped for once by the uſe of the bark; a relapſe is commonly to be expected, and ſhould be prevented by the exhibition of the bark repeated at proper entervals.

The advantage of adminiſtering the bark as early as poſſible, was fully aſcertained by Dr Lind in the years 1765, 66, and 67, during an uncommon prevalence of intermittents. When the diſeaſe was ſtopped by the bark immediately after the firſt or ſecond fit, which was the caſe with 200 of the Doctor's patients as well as himſelf, neither a jaundice nor dropſy enſued; whereas, when the bark could not be adminiſtered, on account of the imperfect remiſſion of the fever, or when the patient had neglected to take it, either a dropſy, jaundice, or conſtant head-ach, were the certain conſequences; and the violence of the diſeaſe was in proportion to the number of the preceding fits, or to the continuance of the fever. By every paroxyſm the dropſical ſwellings were viſibly increaſed, and the colour of the ſkin rendered of a deeper yellow. When the fever continued a few days without remiſſion, the belly and legs generally ſwelled; a violent head-ach, likewiſe, and vertigo; for the moſt part diſtreſſed the patient; ſo that ſome, even after the fever had left them, were not able to walk acroſs their chamber for a fortnight or three weeks. When the returns of the fever were regular and even, but ſlight, four or five fits of a ſimple tertian were ſometimes followed by the moſt dangerous ſymptoms; eſpecially in the year 1765, when theſe fevers raged with the greateſt violence. If, as frequently happened, a dropſical patient relapſed into the ague, there was an abſolute neceſſity for putting an immediate ſtop to it by the bark; and in upwards of 70 ſuch patients, Dr Lind obſerved the moſt beneficial effects to accrue from this practice. He never preſcribed the bark until the patient was free from all ſymptoms of the fever; but in that caſe, without regard to a cough, or any other chronical indiſpoſition, he ordered it to be given in large doſes.

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The bark has been often obſerved to fail in removing intermittents, from not continuing the uſe of it for a ſufficient length of time, from adminiſtering it in too ſmall a doſe, or from giving it in an improper form. It was a prevailing opinion, that an ounce, or an ounce and an half, of the bark, taken during one intermiſſion, is ſufficient to prevent the return of another paroxyſm. But this is not always the caſe; for a ſevere fit will often attack a patient who has taken ſuch a quantity. When this happens the patient ought to perſevere during the following intermiſſions, with an increaſe of the doſe, till five or ſix ounces at leaſt have been taken. The medicine alſo ought not to be omitted as ſoon as one fit is ſtopped, but ſhould be continued in a ſmaller doſe, and after longer intervals, for at leaſt ten days or a fortnight. Even for ſeveral months after the diſeaſe is entirely removed, it would be adviſable to take a little bark occaſionally in damp weather, or during an eaſterly wind, to prevent a relapſe. Where the intervals between the fits are ſhort, as in quotidians and double tertians, from one to two drachms of it ought to be taken every two or three hours.

The form in which this medicine is adminiſtered is of ſome conſequence. Mucilages and ſyrups have been recommended to conceal the taſte of it; but, from various experiments, Dr Lind found nothing more effectual for this purpoſe than ſmall-beer or milk, eſpecially the latter. A drachm of bark mixed with two ounces of milk, and quickly drank, may eaſily be taken by a perſon of the moſt delicate taſte, and by waſhing the mouth afterwards with milk there will not remain the leaſt flavour of the bark; but if the mixture be not drank immediately, the bark will impart a bitter taſte to the milk. This medicine is commonly given in electuaries or boluſes; but Dr Lind obſerves, that in theſe forms it proves much leſs efficacious than when adminiſtered in juleps or draughts, with the plentiful addition of wine or ſpirits. He has remarked, that ſix drachms of powdered bark, given in a julep, conſiſting of one fourth or one third of brandy, is as effectual as an ounce of the powder in the form of an electuary, and proves leſs diſagreeable to the ſtomach. For patients unaccuſtomed to wine or ſpirits, each draught ſhould be warmed with ſpiritus ſalis ammoniaci, or tinct. myrrh. by both of which the efficacy of the bark is increaſed. Dr Lind is alſo fully convinced that wine or ſpirits improve the virtues of the bark much more than elixir vitrioli, tinct. roſar. or ſuch other medicines as have been recommended by different phyſicians.

For thoſe who nauſeate the bark from a weakneſs of

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of the ſtomach or other cauſe, he adviſes it to be given in clyſters, in which form it is as efficacious as when taken by the mouth. For this purpoſe the extract is moſt proper with the addition of a ſufficient quantity of the tinctura thebaica, in order to its being longer retained. For children labouring under intermitting fevers, Dr. Lind orders the ſpine of the back to be anointed at the approach of the fit, with a liniment compoſed of equal parts of tinctura thebaica and liniment ſapon, which has often prevented it. If this ſhould not produce the deſired effect, he informs us, that two or three tea-ſpoonfuls of ſyrup. e. mecon. given in the hot fit, will generally mitigate the ſymptoms. But for the entire removal of the diſeaſe, after purging with magneſia alba, he preſcribes a drachm of the extract. cort. Peruvian, with a few drops of tinct. thebaic. in a clyſter, to be repeated every three hours for a child of about a year old. When the ſtomach is oppreſſed with phlegm, the magneſia frequently occaſions vomiting, which ſhould be promoted with warm water. The conſtant heavineſs of the head occaſioned by thoſe fevers in ſuch tender conſtitutions is beſt relieved by the application of a bliſter to the back.

The bark has alſo proved effectual for the cure of intermittents in children, even when externally applied, by putting the powder of it into a quilted waiſtcoat. Of its efficacy in this way ſeveral inſtances are related by Dr Samuel Pye in the ſecond volume of Medical Obſervations and Inquiries. In ſhort, ſo effectual was the bark found in removing theſe fevers, when properly applied, that of between four and five hundred afflicted with them in the year 1765, Dr Lind loſt only two, neither of whom had taken this medicine.

In all theſe fevers, a vomit was adminiſtered whenever the patient complained of a ſickneſs and reaching to vomit, or was ſeized with a ſpontaneous vomiting; and the bark was never given till this ſickneſs was removed, or a purgative taken to clear more perfectly the whole alimentary canal. In thoſe patients who were troubled with a cough, attended with a pain in the ſide affecting the breathing, when the pain was not relieved by warm fomentations, the balſamum anodynum, or by a bliſter, the doctor generally ordered a few ounces of blood to be taken away, and endeavoured to ſtop the fever as ſoon as poſſible by the adminiſtration of the bark; having found that every return of the fever increaſed all ſuch pains. When the head-ach was very violent, and haraſſed the patient during the intermiſſions, the ſucceſs of the bark was rendered more complete by the application of a bliſter to the back.—A giddineſs of the head, which is the ſymptom moſt commonly remaining after even a ſlight intermitting fever, was generally relieved by the ſal C. C. and the bark in wine. The former of theſe was adminiſtered in the following manner.

℞ Aq. Alex. Simp. ℥vii.
Sal. C. C. ʒſs.
Syr. è Cort. Aurant. ℥i. M. f. julep. Cap. cochlear ij. ſubinde.

If from the continuance of the fever the patient was diſtreſſed with flatulence, a diſtenſion of the abdomen, and a ſwelling of the legs, a ſpoonfull of tinctura ſacra, with the addition of 30 drops of the ſpirit lavend. compoſ. was ordered to be taken every night.—A continuance of the bark, a change of air, and the cold bath, were often found requiſite to prevent a relapſe.

Such is the method of cure recommended by this experienced author, who has alſo diſcovered the efficacy and ſucceſs of opium in intermitting fevers. He informs us, that he has preſcribed an opiate to upwards of 300 patients labouring under this diſeaſe; and he obſerved, that, if taken during the intermiſſion, it had not the leaſt effect either in preventing or mitigating the ſucceeding paroxyſm: when given in the cold fit it once or twice ſeemed to remove it; but when given half an hour after the commencement of the hot fit, it generally gave immediate relief.—When given in the hot fit, the effects of opium are as follow. 1. It ſhortens and abates the fit; and this with more certainty than an ounce of the bark is found to remove the diſeaſe. It generally gives a ſenſible relief to the head, takes off the burning heat of the fever, and occaſions a profuſe ſweat. This ſweat is attended with an agreeable ſoftneſs of the ſkin, inſtead of the burning ſenſation which effects patients ſweating in the hot fit, and is always much more copious than in thoſe who have not taken opium. 3. It often produces a ſoft and refreſhing ſleep to a patient tortured in the agonies of the fever from which he awakes bathed in ſweat, and in a great meaſure free from all complaints.

The Doctor has always obſerved, that the effects of opium are more uniform and conſtant in intermitting fevers than in any other diſeaſe, and are then more quick and ſenſible than thoſe of any other medicine. An opiate thus given ſoon after the commencement of the hot fit, by abating the violence and leſſening the duration of the fever, preſerves the conſtitution ſo entirely uninjured, that, ſince he uſed opium in agues, a dropſy or jaundice has ſeldom attacked any of his patients in thoſe diſeaſes. When opium did not immediately abate the ſymptoms of the fever, it never increaſed their violence. On the contrary, moſt patents reaped ſome benefit from an opiate given in the hot fit, and many of them bore a larger doſe at that time than they could do at any other. The Doctor aſſures us, that even a delirium in the hot fit is not increaſed by opium, though opium will not remove it. Hence he thinks it probable, that many ſymptoms attending theſe fevers are ſpaſmodic; but more eſpecially the head-ach. However, if the patient be delirious in the fit, the adminiſtration of the opiate ought to be delayed until he recovers his ſenſes, when it will be found greatly to relieve the weakneſs and faintneſs which commonly ſucceed the delirium. Dr Lind is of opinion, that opium in this diſeaſe is the beſt preparative for the bark; as it not only produces a complete intermiſſion, in which caſe alone that remedy can be ſafely adminiſtered; but occaſions ſuch a ſalutary and copious evacuation by ſweat, as generally to render a much leſs quantity of bark requiſite. He commonly preſcribes the opiate in about two ounces of tinctura ſacra, when the patient is coſtive, who is to take the bark immediately after the fit. By theſe means the paroxyſm is ſhortened, and the inteſtines are cleanſed,

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In the administration of the Peruvian bark, care should be taken that it be of a good quality. And different opinions have been entertained with respect to the choice, even where there is no reason to believe that it has been adulterated by the mixture of other articles. For a long time, the preference was given to small quilled pieces of a pale coloured bark; but of late the red bark, which is generally in larger masses, of an apparently coarser texture, and evidently of a more resinous nature, has been highly celebrated by Dr Saunders and others. And in cases where it does not disagree with the stomach or excite looseness, it is admitted by the most accurate observers to be more powerful in preventing the return of intermittents. Whether the red bark be the product of a different species of the cinchona, or be obtained as well as the pale quilled bark from the cinchona officinalis, is not yet ascertained with sufficient accuracy.

A species of cinchona, distinguished by the title of *cinchona Jamaicensis*, has been discovered in Jamaica and other islands in the West Indies. A very accurate description of it has been given by Dr Wright of Jamaica in the Philosophical Transactions of London. The bark of this species also has been recommended in the cure of intermittents; but the advantages of it have not hitherto been sufficiently confirmed by experience. See CINCHONA and JESUITS *Bark*.

The barks of various trees readily cultivated in Britain, particularly different species of the salix, the prunus, the fraxinus, and the quercus, have by some been represented as no less efficacious than the Peruvian bark. But we may safely venture to assert, that although several of them may possess some power in stopping intermittents, yet that none hitherto tried can be considered as in any degree approaching to the cinchona in point of efficacy.

But although the Peruvian bark be the best cure for intermittents hitherto discovered, yet while it can by no means be represented as the only cure, it is very certain that other remedies have in different cases succeeded after the cinchona has failed. Cures have often been obtained by the use of different aromatics, bitters, and astringents. Many articles from the mineral kingdom also have been employed with advantage. And intermittents have unquestionably been in certain cases stopped by different preparations of iron, zinc, copper, lead, and mercury. But of all the articles of this nature, arsenic has of late been the most celebrated. Arsenic is on good grounds conjectured to be the basis of an article much employed in the cure of intermittents in some of the countries where they are most prevalent, and sold under the title of the *tasteless ague drop*. The great success attending the use of this article, led Dr Fowler, an ingenious physician of Stafford, to examine it with particular attention. And in a treatise which he has lately published, entitled *Medical Reports* on the effects of arsenic in the cure of agues, he has given a formula for an arsenical solution, which he has found very successful in affections of this kind, and which is probably very nearly the same with the tasteless ague drop. Dr Fowler's mineral solution, as he styles it, is found by dissolving 64 grains of arsenic and as much fixed vegetable alkaline salt in a pound of distilled water. This solution is given in doses from three to 12 drops, varied according to the condition of the patient, and repeated two or three times a-day. And where the Peruvian bark has failed in stopping intermittents, it seems to be one of the most powerful remedies yet discovered. But after all remedies prove ineffectual, intermittents are often stopped by change of season and of situation.

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But besides the remedies employed in tertian fevers and other intermittents, with the view of preventing the return of paroxysms, it is often also necessary to employ powerful articles with other intentions, particularly to mitigate and shorten the paroxysm when present; to obviate urgent symptoms, especially those of an inflammatory or putrid nature; and to obtain a complete apyrexia or intermission from fever after the paroxysm has ceased. With these intentions, recourse is not unfrequently had to emetics, laxatives, bloodletting, blisters, opium, diluents, or sudorifics, as the circumstances of the case may require.

The *Irregular* or *Spurious* TERTIAN. 127
Sp. I. var. 1. B.

Tertiana notha sive spuria, *Sauv.* sp. 2. *Sennert. Cleghorn. Hoffman.*

The characteristic marks of this fever are, that its paroxysms last longer than 12 hours, and consequently it inclines more to the quotidian or continued fever than the former. Its paroxysms have no stated hour of attacking. The cure, however is precisely the same with that above described, observing the proper cautions already mentioned with regard to the use of the bark.

The *Double* TERTIAN. Sp. I. var. 2. C. 128

Tertiana duplex, *Sauv.* sp. 13. *Vog.* G. 12. *Sennert. Cleghorn.*

Duplicata, *Lin.* 18.

The double tertian comes on every day; but differs from the quotidian in so far, that its paroxysms do not answer to each other singly, but alternately. The first day, for instance, the fit will come on in the forenoon, the second in the afternoon, the third in the forenoon, and the fourth in the afternoon.

Of these fevers we shall give the following description from Cleghorn's treatise on the diseases of Minorca: "They are called *double tertians* when there are two fits and two intervals within the time of each period. But commonly there is some difference between the two fits, either in respect of the hour they come at, the time of their duration, or the nature and violence of their concomitant symptoms. Some double tertians begin in this manner.—On the evening of Monday, for example, a slight fit comes on, and goes off early next morning; but on Tuesday, towards the middle of the day, a more severe paroxysm begins, and continues till night. Then there is an interval to Wednesday evening, when a slight fit commences a new period of the fever, which proceeds in the same manner as the first; so that (according to the way physicians calculate the days of diseases, by beginning

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to reckon from the first hour of their invasion), both paroxysms happen on the odd days, while the greatest part of the even days is calm and undisturbed. But in most double tertians the patient has a fit every day of the disease; the severe one commonly appearing at noon upon the odd days, the slight one towards evening on the even days; though sometimes the worst of the two fits happen on the even days.

"There is a tertian fever sometimes to be met with, during each period of which there are three different fits, and as many intervals. For example, towards Monday noon the patient is seized with a paroxysm, which declines about five or six o'clock the same evening: a few hours after, another fit begins, and continues until morning: from which time there is an interval to Tuesday evening, when a third fit comes on, and lasts most part of the night. On Wednesday there are again two paroxysms, as on Monday and on Thursday, like that of Tuesday; and thus the fever goes on with a double fit on each of the odd days, and a single fit on the even days.

"In double tertians, that interval is the most considerable which follows the severe fit; for the slight fit oftener ends in a remission than intermission, and frequently lingers till the other approaches: Hence it is, that the night preceding the vehement fit is much more restless than that which comes after it, as has been observed by Hippocrates. In double tertians, the vehement fit often comes on a little earlier in each period, while the slight fit returns at the same hour, or perhaps later and later every other day: so that the motions of one have no influence on those of the other; from whence it appears, that each of these fits hath its own proper independent causes."

129 *Duplicated* TERTIAN. Sp. I. var. 2. D.

Tertian duplicata, *Sauv.* sp. 14. *Jones. River.*

This hath two fits on the same day, with an intermediate day on which there are none. This also does not differ in any remarkable particular from those already described.

130 The *Triple* TERTIAN. Sp. I. var. 2. E

Tertia triplex, *Sauv.* sp. 15. *Cleghorn.*

Semitertiana, *Hoffman.*

Semitertiana secundi ordinis, *Spig.*

This differs from the former in having a single and double fit alternately: thus, for instance, if there are two fits the first day, there is only one the second, two the third, one the fourth, &c. Its cure the same as before.

131 The *Semi*-TERTIAN. Sp. I. var. 2. F.

Hemitritæus, *Cels.*

Semitertiana, *Cleghorn.*

Semitertiana secundi ordinis, *Spig.*

Amphimerina hemitritæus, *Sauv.* sp. 8.

Amphimerina pseudo hemitriæus, *Sauv.* sp. 9.

The semitertian is described by Dr Cullen as having only an evident *remission* between its paroxysms; more remarkable between the odd and even days, but less so between the even and odd one. For this reason, he adds, that possibly some semitertians ought rather to be classed among the remittents; and owns that it is difficult to settle the boundaries between them. But Cleghorn, whom he quotes, describes it in the following manner. "A fit begins on Monday noon, for example, and goes off the same night. On Tuesday afternoon a second fit comes on, and gradually increases till Wednesday night, when it terminates. On Thursday morning there is such another interval as happened on Tuesday morning: But on Thursday afternoon another long fit like the preceding commences; and returning regularly every other day, leaves only a short interval of ten or twelve hours during the eight and forty.

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Concerning the cure of these fevers Dr Cullen observes, that though no entire apyrexia occurs, the bark may be given during the remissions; and it should be given even though the remissions be inconsiderable; if, from the known nature of the epidemic, intermissions or considerable remissions are not to be expected, and that great danger is apprehended from repeated exacerbations.

The *Sleepy* TERTIAN. Sp. I. var. 3. G. 132

Tertiana carotica, *Sauv.* sp. 10. *Werlhof.*

Tertiana hemiplegica, *Sauv.* sp. 20. *Werlhof.*

Quotidiana soporosa, *Sauv.* sp. 8 *Car. Pis.*

Febres caput impetentes, *Sydenham*, ep. ad R. Brady.

This, according to Vogel, is a most dangerous species, and very commonly fatal; for which reason he ranks it among those intermittents which he calls *malignant.* Sometimes he tells us the alarming symptom of a sleepiness comes on, not at the beginning of the disease, but will unexpectedly occur during the third fourth, fifth, or sixth paroxysm. It commonly begins with the cold fit, and continues during the whole time of the paroxysm, and, becoming stronger at every succeeding one, at last terminates in a mortal apoplexy. Sometimes fevers of this kind rage epidemically. Vogel relates, that he saw a simple tertian change into one of these dangerous fevers. The patient was a woman of a delicate constitution, and the symptom appeared in consequence of her being put in a violent passion: however, it occurred but once, and she recovered. Hoffman mentions a carus in a double tertian occurring seven times without proving mortal; though Vogel says, that the powers of nature are very seldom sufficient to conquer the disease.

In 1678, Dr Sydenham tells us that intermittents raged epidemically at London, where none had appeared before from 1664. Of them "it is to be noted (says he), that though quartans were most frequent formerly, yet now tertians or quotidians were most common, unless the latter be intitled double tertians; and likewise, that though these tertians sometimes began with chilness and shivering, which were succeeded first by heat, and soon after by sweat, and ended at length in a perfect intermission, returning again after a fixed time, yet they did not keep this order after the third or fourth fit, especially if the patient was confined to his bed and used hot cardiacs, which increase the disease. But afterwards this fever became so unusually violent, that only a remission happened in the place of an intermission; and approaching every day nearer the species of continued fevers, it seized the head, and proved fatal to abundance of persons."

From this description of Sydenham's we may have an idea of the nature of the disease. As to its cure, he

Febres. he ſtrongly recommends the bark; telling us, that, even in the *moſt continued* kind of intermittents, "the nearer the intermittent approaches to a continued fever, either ſpotaneouſly, or from uſing too hot a regimen, ſo much the more neceſſary is it to exhibit a larger quantity of the bark; and that he took advantage of a remiſſion, though ever ſo ſmall.

133 The *Spaſmodic* or *Convulſive* TERTIANA. Sp. I. var. 3. H.

Tertiana aſthmatica, *Sauv.* ſp. 6. *Bonet.*
Tertiana hyſterica, *Sauv.* ſp. 8. *Wedel.* A. N. C. Dec. I. A. II. obſ. 193.
Hyſteria febricoſa, *Sauv.* G. 135. ſp. 8. A. N. C. Dec. I. Ann. II.
Tertiana epileptica, *Sauv.* ſp, 16. *Calder. Lautter.*
Quotidiana epileptica, *Sauv.* ſp. 3. Edinb. Eſſays, Vol. 5. art. 49.
Ecclampſia febricoſa, *Sauv.* G. 133. ſp. 17.
Epilepſia febricoſa, *Sauv.* G, 134. ſp. 9.
Tertiana tetanodes *Medici* Beobacht I. Band.
Tetanus febricoſus, *Sauv.* G. 122. ſp. 10. *Stork*, Ann. Med. II.

Tertians of this kind occur with very different ſymptoms from thoſe of the true ones, and ſometimes even with thoſe which are very extraordinary. In ſome they are attended with ſymptoms of aſthma, in others with thoſe of hyſterics, in others with convulſions. Where the ſymptoms of aſthma occur, the diſeaſe muſt be treated with diuretics and antiſpaſmodics joined with the bark. In the hyſteric aſthma the fit comes on with cold, yawning, cardialgia, terror and dejection of mind. The diſeaſe is to be removed by mild aperients and antihyſterics joined with the bark.

Of the convulſive tertian we have a moſt remarkable inſtance in the Edinburgh Medical Eſſays, Vol. V.

The patient was a farmer's ſon about 26 years of age, of a ſtrong plethoric habit of body. He had laboured under an ague half a-year, and had taken a great deal of bark. While he was telling his caſe to the ſurgeon (Mr Baine of Pembroke), he was ſuddenly taken with a violent ſtamping of his feet; and the convulſions gradually aſcended from the ſoles of the feet to his legs, thighs, belly, back, and ſhoulders. His head was then moſt violently convulſed, with a total deprivation of ſpeech; but he had a moſt diſmal vociferation, that might have been heard at a conſiderable diſtance, his abdomem and thorax working and heaving violently and unuſually in the mean time. This fit having laſted half an hour, a profuſe ſweat broke out over all his body, which relieved him; and he then became capable of anſwering ſuch queſtions as were put. Theſe extraordinary fits, he ſaid, had been occaſioned by a fright, and his neighbours had concluded that he was bewitched. They returned ſometimes twice a-day, and always at the times the ague uſed to return. During the paroxiſm his pulſe was very high and quick, his face much inflamed, and his eyes ready to ſtart out of his head. After the fit was over, he complained of a moſt torturing pain of the bowels. His tongue was generally moiſt, and he had a ſuppreſſion of urine.—This formidable diſeaſe, however, was totally ſubdued by the uſe of the bark, mercurials, antiſpaſmodics opiates, and ſaline draughts.

The *Eruptive* TERTIAN. Sp. I. var. 3. I. Tertiana.

Tertiana petechialis, *Sauv.* ſp. 3. *Donat. Lautter.*
Tertiana ſcorbutica, *Wedel.* A. N. C. Dec. I. A. II. obſ. 193. 134
Tertiana urtica, *Sauv.* ſp. 22. *Planchon.* Jour. de Med. 1765. *Cleghorn.*
Tertiana miliaris, *Sauv.* ſp. 21. Walthier.

This ſpecies of tertian is accompanied with red or livid blotches on the ſkin, or an eruption like that occaſioned by the ſtinging of nettles. In the latter caſe Dr Cleghorn ſays the diſeaſe is very dangerous; and as the former indicates an incipient diſſolution and putrefaction of the blood, it muſt alſo be reckoned of very dangerous tendency.

The *Inflammatory* TERTIAN. Sp. I. var. 3. K. 135

Tertiana pleuritica, *Sauv.* ſp. 4. *Valeſ. Lautt.*
Pleuritis periodica, *Sauv.* G. 103. ſp. 14.
Tertiana arthritica, *Sauv.* ſp. 5. *Morton. Lautt.*

Sauvages informs us, that he has ſeen a true and genuine pleuriſy having all the pathognomic ſigns of the diſeaſe, but aſſuming the form of an intermittent; that is, the patient is one day affected with the pleuriſy, and the next ſeemingly in perfect health. He alſo tells us, that in the month of May 1760 a tertian raged epidemically, which after the third fit imitated a pleuriſy, the pain of the ſide and difficulty of breathing coming regularly on, and the fever from an intermittent becoming remittent; the blood had alſo the ſame appearance with that of pleuritic perſons, and the diſtemper yielded to bleeding and gentle cathartics.—Morton alſo informs us, that he has obſerved ſimilar diſorders an hundred times over, which were always certainly and ſafely cured by the Peruvian bark.

The TERTIAN *complicated* with other *Diſorders*, 13
Sp. I. var. 4.

Tertiana ſcorbutica, *Sauv.* ſp. 9. *Etmuller. Timæus.*
Tertiana ſyphilitica, *Sauv.* ſp. 17. *Deidier.*
Tertiana verminoſa, *Sauv.* ſp. 18. *Stiffer.* in act. Helmſtad. *Lanſcif.* de noxis pallud. *Pringle. Rammazzini. Van den Boſch.* de conſt. vermin.

The ſcorbutic tertian, according to Sauvages, is exceedingly anomalous, its periods being ſometimes much anticipated, and ſometimes much poſtponed. It is exceedingly obſtinate, and will return if the body be not cleared of its ſcorbutic taint. The patient is affected with lancinating pains of a wandering nature. The urine lets fall a duſky red ſediment, or a thick branny matter is copiouſly ſcattered up and down in it, ſeemingly tinged with blood. The uſual ſymptoms of ſcurvy, viz. livid ſpots, and rotten fetid gums, alſo frequently occur. For this the Peruvian bark, is very uſeful, both as a febriſuge and antiſcorbutic.

A tertian accompanied with worms is taken notice of by Sir John Pringle in his treatiſe on the diſeaſes of the army. The worms, he tells us, were of the round kind; and though we are by no means to reckon them the cauſe of the fever, they never failed to make it worſe, occaſioning obſtinate gripings or ſickneſs at ſtomach. In theſe caſes ſtitches were frequent; but, being flatulent, were not often relieved by bleeding. The worms were diſcharged by vomiting as

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as well as by ſtool. For diſcharging theſe worms, he commonly gave half a drachm of rhubarb with 12 grains of calomel; without obſerving any inconvenience from ſuch a large doſe of mercury. Anthelmintics, which act ſlowly, had little chance of doing good; for though worms will ſometimes lie long in the bowels without giving much uneaſineſs to a perſon otherwiſe well, yet in fever, eſpecially one of a putrid kind (to which his intermittents always ſeemed to incline), the worms being diſturbed by the increaſe of heat, and the corruption of the humours in the *primæ viæ*, begin to move about, and ſtruggle to get out. Lanciſius, who makes this remark, adds, that upon opening the bodies of ſome who had died at Rome of fevers of this kind, wounds were found in the inteſtines made by the biting of the worms; nay, that ſome of them had even pierced through the coats of the guts, and lay in the cavity of the abdomen. Pringle never had any inſtance of this; but knew many caſes in which the worms eſcaped by the patient's mouth, though there had been no previous retching to bring them up. One ſoldier was thrown into violent convulſions, but was cured by the above-mentioned powder.

137 The TERTIAN *varied* from its *Origin*. Sp. I. var. 5.

Tertiana accidentalis, *Sauv.* Sp. 12. *Sydenham*..
Tertiana a ſcabie, *Sauv.* ſp. 12. *Juncker*, tab. 80. *Hoffman*, II. p. 12.

The exiſtence of fevers of this kind, as we have already obſerved, is denied by Dr Cullen; the accidental fever of Sauvages was ſaid to ariſe from any ſlight error in the non-naturals, and conſequently was very eaſily cured. That which aroſe from the repulſion of the itch, was cured as ſoon as the eruption returned.

138 Remittent Tertian. The TERTIAN with only *remiſſion* between the fits. Sp. II.

Tritæophya, *Sauv.* Gen. 85. *Sag.* p. 695.
Tritæus, *Lin.* 21.
Hemitritæa, *Lin.* 23.
Tertianæ remittentes et continuæ Auctorum.
Tertianæ ſubintrantes, proportionatæ, ſubcontinuæ, *Torti.*
Tertiana ſubcontinua, *Sauv.* ſp. 19.
Quotidiana deceptiva, *Sauv.* ſp. 2.
Amphimerina ſemiquintana, *Sauv.* ſp. 24.
Tritæophya deceptiva, *Sauv.* ſp. 10.
Cauſos *Hippocratis.*
Tritæophya cauſus, *Sauv.* ſp. 2.
Febres ardens *Boerhaavii*, aph. 738.
Tertiana perniciosa, quæ ſimulata tertiani circuitus effigie lethalis, et mille accidentibus periculoſiſſimis implicata, exiſtit. *Lud. Mercatus.*
Tertiana peſtilens, *P. Sal. Diverſus.*
Tertiana maligna peſtilens, *Riverii.*
Morbus. Hungaricus. *Lang. Lemb. Sennert. Jordan.*
Languor Pannonicus, *Cober.*
Amphimerina Hungarica, *Sauv.* ſp. 10.
Hemitritæus peſtilens, *Schenck.* ex *Corn. Gamma.*
Febres peſtilentes Ægyptiorum, *Alpin.*
Febres tertiana epidemia, *Bartholin.*
Febres epidemicæ, autumni 1657 et 1658, *Willis.*
Febres ſyneches epidemica, ab anno 1658 ad 1664. et poſtea ab anno 1673 ad 1601, *Morton.*
Febres autumnales incipientes, *Sydenham.*
Affectus epidemicus Leidenſis, *Fr. Sylvii.*
Morbus epidemicus Leidenſis, 1669, *Fanois.*
Tertianæ peniciosæ et peſtilentes, et febres caſtrenſes epidemiæ, *Lanciſi.*
Febres intermittentes anomalæ et mali moris, *Hoffman.*
Febres cholerica minus acuta, *Hoffman.*
Febres epidemica Leidenſes, anno 1719, *Koker* apud *Holler*, Diſp. tom. V.
Amphimerina paludoſa, *Sauv.* ſp. 19.
Febres paludum, *Pringle.*
Bononienſis conſtitutio hiemalis 1729, *Beccari* in A. N. C. Vol. III.
Amphimerina biliosa, *Sauv.* ſp. 22.
Febris caſtrenſis, *Pringle.*
Febris putrida epidemica, *Huxham de aëre ad ann.* 1729.
Febris biliosa Lauſanenſis, *Tiſſot.*
Tritæophya Wratiſlavienſis, *Sauv.* ſp. 3. Hahn. Epidemia verna Wratſlav. in App. ad. A. N. C. Vol. X.
Tritæophya Americana, *Sauv.* ſp. 12.
Febris anomala Batava, *Grainger.*
Morbus Naronianus, *Pujati.*
Febris continua remittens, *Hillary's* diſeaſes of Barbadoes.
Febris remittens Indiæ orientalis, *Lind.* diſſ. inaug. 1768.
Febris critica et febr. Biliosa æſtatis, *Rouppe.*
Febris remittens regionum calidarum, *Lind* on the diſeaſes of hot climates.

A. Tertiana cholerica five dyſenterica, *Tort.* Therap. Special. lib. iii. cap. 1. *Leutter.* Hiſt. Med. caſ. 6. 16. 17. 20. *Morton*, App. ad Exerc. II.
B. Tertiana ſubcruenta ſive atrabilaris, *Tort.* ibid. Never ſeen by *Cleghorn.*
C. Tertiana cardiaca, *Tort.* ibid. *Lautter*, Hiſt. Med. caſ. 15. 15. 23.
Amphimerina cardiaca, *Sauv.* ſp. 5.
Tritæophya aſſodes, *Sauv.* ſp. 6.
Febris continua aſſodes, *Vog.* 27.
D. Tertiana diaphoretica, *Tort.* ibid.
Tritæophya typhodes, *Sauv.* ſp. 4.
Tritæophya elodes, *Sauv.* ſp. 5.
Febris continua elodes, *Vog.* 21.
E. Tertiana ſyncopalis. *Tort.* ibid. *Lautter.* caſ. 11. 12. 13. 15. 16.
Tritæophya ſyncopalis, *Sauv.* ſp. 1.
Amphimerina ſyncopalis, *Sauv.* ſp. 4.
Amphimerina humoroſa, *Sauv.* ſp. 6.
Amphimerina ſyncopalis, *Vog.* 29.
F. Tertiana algida, *Tort.* ibid. *Lautter*, caſ. 13.
Amphimerina epiala, *Sauv.* ſp. 3.
Amphimerina phricodes, *Sauv.* ſp. 7.
Triteophya leipyria, *Sauv.* ſp. 9.
Tertiana leipyria, *Sauv.* ſp. 23. *Valcarenghi* Med. Ration. p. 18.
Febris continua epiala et leiparia, *Vog.* 19. et 24.
G. Tertiana lethargica, *Tort.* ib.
Tritæophya carotica, *Sauv.* ſp. 7. *Lautter*, 1. 7. 14.

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Tertiana apoplectica, *Morton*. Exerc. I. cap. ix. hist. 25.

Tertiana soporosa, *Werlhof*. de febr. p. 6.

Febris epidemica Urbevetana, *Lancis*. de noxis pal. effluv. I. II. c. 3.

The remittent fevers are much more dangerous than the true intermittents, as being generally attended with much greater debility of the nervous system and tendency to putrescency in the fluids than the latter. Sauvages divides his tritæophya, a remittent tertian, into the following species.

139 1. *Tritæophya syncopalis*, or that attended with fainting. It begins like a tertian, with cold succeeded by heat and profuse sweating; but attended with much more dangerous symptoms, such as cardialgia, enormous vomiting, great weakness, small contracted pulse, coldness of the extremities, and, unless timely assistance be given, kills during the second or third paroxism.

140 2. The *causus*, or burning fever of Hippocrates, returns every third day without any new sensation of cold; and is attended with great thirst, heat, but without diarrhœa or sweat, and continues only for one week or two at the utmost. It attacks chiefly young people of a robust and bilious habit of body, who have been accustomed to much exercise, and exposed to the sun during the heats of summer, and have also used a phlogistic regimen. The tongue is dry, sometimes black; the urine of a red or flame colour; together with pain of the head, anxiety, and sometimes other symptoms still more dangerous.

141 3. *Tritæophya Vratislaviensis*, was a pestilential disease occasioned by famine, during which the people fed on putrid aliments: the air was infected by the vast numbers of bodies of those slain in battle, and the inhabitants were also dejected by reason of being deprived of their harvest and other calamities; to all which was added the continuance of a calm in the atmosphere for a long time. It began with an acute fever, leipyria or coldness of the external parts and sensation of burning heat inwardly; general weakness; pain of the head and præcordia: serous or bilious diarrhœa; a delirium, in some furious, and accompanied with a dread of being exposed to the air; on the second day the thirst was violent, attended with a bilious vomiting as well as diarrhœa, tough viscid spitting, fainting, burning heat in the bowels, the tongue dry and seeming as if burnt with a hot iron, a suppression of the voice, anxiety, stupor; after which quickly followed convulsions and death. In some fevers à leipyria came on with an exceeding great cold of the extremities, presently followed by an intolerable heat of the viscera, with symptomatic sweats, violent diarrhœa, followed by a very itchy miliary eruption. On the fourth day came on copious sweats, spasms of the lower jaw, nausea, involuntary passing of urine, slight delirium, a flux of ichorous matter from the nostrils, and exceeding tough spitting, an epilepsy, and death. Professor Hahn, who gives the History of this disease, was himself attacked by it, and suffered in the following manner. On the first day was a violent feverish paroxism without rigor, a sharp pain in the occiput, and immediately an inflammatory pain over the whole head; the feet were extremely cold, and the extremities rigid with spasms. The pain continued to increase daily to such a degree, that the contact of the air itself became at last intolerable; a dejection of mind and incredible weakness followed; he passed restless nights with continual sweating, heavy and pained eyes, and an unusual sensation of rheumatism over the whole body. On the third day the pains were assuaged, but he had a very bad night. On the fourth day all the symptoms were worse, the feet quite chilled, the hands very red and agitated with convulsive motions; he was terrified with apprehensions of death, and had a vomiting every now and then: this day sponges dipped in cold water were applied over the whole body, and he used cold water for his drink. On the eighth day the pulse was convulsive; and the pains were so violent, that they made him cry out almost continually. On the ninth day he was delirious, and threw up some grumous blood. On the 11th his pulse was more quiet, and he had a sweat; a decoction of the bark was given; his voice was broken, his speech interrupted, and his teeth chattered upon one another. On the 12th his jaw was convulsed, he had a risis sardonicus, and deafness; after which, the paroxysms returned less frequently, and only towards night. On the 14th he had a chilling cold over the whole body, a cold sweat; frequent lotions were applied, and all the symptoms became milder. On the 18th he had a quick delirium, but fainted as soon as taken out of bed; a sensation of hunger, followed by copious sweats; profound sleep; an aversion from noise; every thing appeared new and extraordinary. On the 36th a cholera; on the 48th a scaling off of the skin, and falling off of the nails. This epidemic carried off above 3000 people at Warsaw. Frequent lotion of the body either cold or tepid, watery glysters, and the copious introduction of watery fluids under the form of drink, were of service. But the most favourable crisis was under the form of some cutaneous eruption.

142 4. *Tritæophya typhodes*. The principal symptom of this fever was a continual sweat with which the patients were almost always wet; with paroxisms returning every third day. Sauvages tells us, that he had twice an opportunity of observing this fever; one was in the teacher of an academy, about 40 years of age, and of a melancholic temperament. He sweated every other night so plentifully, that he was obliged to change his linen nine times; and even on the intermediate days was never perfectly free of fever, and had his skin moistened with sweat. The other was of a woman who went about in man's cloathes, and was discovered only after her death. The disease began with a slight sensation of cold, after which she sweated for eight hours. It was attended with the highest debility, anxiety, and at the same time an insatiable hunger.

143 5. *Tritæophya elodes*, was an inflammatory epidemic, but not contagious, terminating about the 14th or 21st day. The disease came on in the night-time, with disturbed rest, universal weakness, watchings, great heat and sweat, redness of the face and almost of the whole body, sparkling eyes, the tongue dry and white; a hard, tense, and turgid pulse: about the third day a kind of frenzy frequently came on with the feverish paroxysm, the forerunner of an universal miliary eruption; or, what was worse, with purple spots so close together, that they looked like an erysipelas

Febres. of the whole body. Sometimes blisters of the size of small pearls, filled with acrid serum, appeared on the neck, armpits, and trunk of the body, which were of all others the most dangerous. There was a variety of the disease, which our author calls the *humoralis*, and in which the pulse was soft and feeble, with greater weakness over the whole body, and the disposition to sleep more frequent than in the other; the eyes languid; the tongue very white, but not dry; and worms were discharged.

144 6. *Tritæophya assodes.* This species arose from a foulness of the primæ viæ, and the effluvia of waters in which hemp had been steeped. It began with rigor, followed by great heats, restlessness, tossing of the limbs, terrible faintings, immoderate thirst, dryness of tongue, delirium, and at length excessive watchings; these last, however, were less dangerous than vertigoes or comatose dispositions, which brought on convulsions or apoplexies.

145 7. *Tritæophya carotica.* This had exacerbations every other evening; and its distinguishing symptom was an excessive inclination to sleep, preceded by a severe headach, and followed by delirium, and sometimes convulsions; the tongue was black, and the patient insensible of thirst after the delirium came on. In those cases where the disease proved fatal, a subsultus tendinum and other grievous symptoms came on.

146 9. *Tritæophya leipyria* is only a variety of the tritæophya causus, already described.

147 10. *Tritæophya deceptiva.* This species at first assumes the appearance of a continued fever; but afterwards degenerates into a remittent, or even an intermittent. It is described by Sydenham, but attended with no remarkable symptoms.

148 11. The last of Sauvages's species of Tritæophya belonging to the remitting tertian is the *Americana.* This, according to Sauvages, is the ardent fever with which the Europeans are usually seized on their first coming to America, and generally carries off one half of them. Of this there are two varieties, the *very acute* and the *acute.* The very acute ends before the seventh day. It comes on a few days after the person's arrival, with loss of appetite, with dyspnœa and sighing from weakness, head-ach, lassitude, pain of the loins: a pyrexia succeeds, with great thirst, sweat, and heat; the sickness increases, nausea comes on, with vomiting of porraceous bile; the tongue rough, the extremities often cold; watching, furious delirium; and the patient frequently dies on the third day. Copious sweats, and a plentiful hemorrhagy from the nose on the fifth day, but not sooner, are serviceable; but a bilious diarrhœa is the best crisis of all.

The acute kind terminates most frequently on the ninth, but very rarely goes beyond the fifteenth day. Death frequently comes on between the fourth and seventh days. It begins with head-ach, pain in the loins, and sometimes shivering; great lassitude, dyspnœa, thirst; burning fever, increasing every third day; inflation of the abdomen, pain at the pit of the stomach, nausea, and bilious vomiting. Such is the state of the disease within twenty-four hours. The eyes are red, and full of tears; the urine pellucid; there is a low delirium, and continual anxiety; the tongue is dry and red, and sometimes, though rarely, black, which is a still worse sign; the pulse, formerly strong and full, sinks about the fourth day, and becomes tense and spasmodic: if a carus then comes on, the patient dies the fifth or sixth day; but if the pulse keeps up, and no carus comes on, a crisis is to be expected by sweat, by a copious hemorrhagy from the nose, or, which is still more safe, by a bilious diarrhœa, which is never salutary if it comes on before the fifth day.

Tertiana. To the Remitting tertian also belong the following species mentioned by Sauvages, viz.

149 1. *Tertiana subcontinua.* This begins like a genuine tertian, and at first hath distinct paroxysms; but these grow gradually more and more obscure, the disease acquiring daily more of the appearance of continued fever, by which it is to be distinguished from the other varieties of this species. It is not unfrequently joined with those symptoms which attend the fatal fever already mentioned; as cardialgia, cholera, syncope, &c. but in a much less degree. The disease commonly begins with little or no sense of cold, but rather a sensation of heat; when the tertian is doubled, it has first a slighter and then a more severe fit; and thus goes on with an exacerbation on the even days: and though it should change from a double into a single tertian, we are still to suspect it, if a weak fit is the forerunner of a very strong one. This change of the tertian into a continued fever is also to be prognosticated if a heat remarkable to the touch is perceived on the day of intermission, together with some disturbance of the pulse, thirst, and dryness of the tongue; all of which show an universal tendency to inflammation: the same is foretold by the urine being in small quantity, and very red, or of a saffron colour; also an ulcerous or aphthous inflammation of the throat, with difficulty of swallowing, or any very severe symptom coming on in the beginning of the disease, excepting only a delirium, which is easily removed.

150 2. *Quotidiana deceptiva.* This is a disorder of an inflammatory kind, with a strong tendency to putrescency, and sometimes assumes the form of a quotidian. In it the patient frequently complains of cold when he really is hot, and the remission is very indistinct; and the disease is known by the great languor of the patient and the foulness of his tongue.

151 3. *Amphimerina cardiaca* is an acute malignant fever, with daily exacerbations, attended with fainting and vomiting of green bile. Afterwards, the weakness increasing, the patient's extremities grow cold, and a profuse sweat comes on, which is frequently succeeded by death on the fourth day. Another species resembling this Sauvages calls the *syncopalis;* but the cardiaca differs from it in being attended with cardialgia.

152 3. *Amphimerina paludosa.* This is the fever described by the British physicians under many different names, and appearing under various forms, according to the different constitutions of the patients. This fever in the East Indies, according to Dr Lind of Windsor, generally comes on suddenly, and begins with a sense of debility and very great lowness of spirits. These symptoms are attended with a greater or less degree of chillness, a dizziness, a nausea, very acute pains in the head and loins, and a trembling of the hands; the countenance is pale, the skin commonly very dry and corrugated, the eyes dull and heavy, the pulse quick and small, the breath generally difficult, and interrupted with hiccough.

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As the paroxyſm increaſes, the chillineſs now and then gives way to irregular heats, which ſoon become violent and permanent; the nauſea likewiſe increaſes; and in ſome there comes on a vomiting, in which they throw up a great deal of bile. Sometimes bile is likewiſe voided by ſtool. The ſkin grows red; the eyes ſmall, and ſometimes not a little inflamed. The pulſe becomes fuller, and the breathing more difficult, attended with great reſtleſſneſs and a troubleſome thirſt; notwithſtanding which (ſo great is the nauſea) the patient cannot endure any kind of liquids. The tongue becomes foul, and the pain of the head and loins more violent; a delirium then follows; a ſlight moiſture appears on the face, and from thence ſpreads to the other parts; whilſt the violence of the other ſymptoms abates, and ſhows the beginning of a remiſſion, which is completed by plentiful ſweats.

On the fever's remitting, the pulſe returns almoſt to its natural ſtate; the pains of the head and loins ſtill continue, though ſomewhat leſs violent, as likewiſe the nauſea and want of appetite. When the diſeaſe gains ſtrength, the remiſſion is ſcarcely obvious, and is immediately followed by another paroxyſm; which begins, not indeed with ſo great a ſhivering, but is attended with a greater pain of the head, the greateſt anxiety, a heartburn, nauſea, vomiting, and bilious ſtools. The matter moſt commonly evacuated by vomit and ſtool is whitiſh like chalk and water, or curdled milk which is vomited by ſucking children, when the curd is much broke down. A heat, immoderate thirſt, and delirium, now come on. The tongue becomes more foul; the teeth and inſide of the lips are covered with a black cruſt; the breath grows hot and fetid: another remiſſion enſues, attended with a ſweat; but this remiſſion is both ſhorter and leſs obvious than the firſt.

This ſecond remiſſion is ſucceeded by a paroxyſm, in which the ſymptoms are far more violent than in the former; that which the patient diſcharges by vomiting and purging is more fetid; the mouth, teeth, and inſide of the lips, are not only covered with a black cruſt, but the tongue becomes ſo dry and ſtiff, that the patient's voice can ſcarce be heard. Violent delirium, with reſtleſſneſs and anxiety, come on chiefly during the paroxyſm; nor do theſe ſymptoms abate till the fever remits, and the patient ſweats.

When the fever becomes ſo violent, during the third fit, as to end in death, which is generally the caſe, ſome of the ſick have a coma; in others the delirium becomes more violent. The diſcharges now become more fetid, and have a cadaverous ſmell; the ſtools are involuntary; the pulſe is ſo quick, ſmall, and irregular, that it is ſcarce to be counted, or even felt; a cold ſweat is diffuſed over the whole body, eſpecially the head and neck: the face becomes Hippocratic and convulſed; the patient picks the bed-clothes; a ſubſultus tendinum comes on; the ſick lie conſtantly on their backs, and inſenſibly ſlide down to the foot of the bed; their extremities grow cold; they are then ſeized with convulſions, with which the ſcene cloſes.

In this fever, the urine, which at the beginning is pale, becomes of a deeper colour by degrees, but without depoſiting any ſediment. There ſeldom or never appear any petechiæ, and the prickly heat which was before on the ſkin vaniſhes on the firſt appearance of the fever. But though theſe were the general ſymptoms of this diſorder, they varied in the different ſubjects, and at different ſeaſons of the ſame year. The pulſe, for example, in ſome, was quick in the beginning of the diſorder; in others, it varied with the other ſymptoms. The ſkin was generally dry in the beginning of the fit; but in ſome it was moiſt, and covered with ſweat from the very firſt beginning of the diſeaſe. In the month of September, when the diſorder raged moſt, the remiſſions were very imperfect and obſcure; but, on the return of winter and the healthy ſeaſon, they became more regular, and the diſeaſe aſſumed the appearance of an intermitting fever, to ſuch a degree as at length not to be diſtinguiſhed from it. In ſome the remiſſions could ſcarce be perceived, and the fever continued for two weeks without any material change for the better or the worſe. At this time numbers were ſeized with it. When the diſorder continued for any time without a change, it generally ended in death; while the weather grew better, it ſometimes, in the ſpace of a few days, from a common fever became an intermitting one, and the patient recovered, unleſs his liver, which was ſometimes the caſe, happened to be affected. The cure of an inflammation of the liver proved uncertain and tedious; as it was commonly followed by a colliquative diarrhœa, which generally endangered the patient's life.—Every ſucceeding paroxyſm was obſerved to be more dangerous than the preceding; the third generally proved fatal; ſome died during the firſt. When this happened, the fever, in the language of the country, was called *puca*, that is a ſtrong fever.

Tertiana.

This diſeaſe, according to Dr Lind of Haſlar hoſpital, is the autumnal fever of all hot countries, the epidemic diſeaſe between the tropics, and the diſeaſe moſt fatal to Europeans in all hot and unhealthy climates. All authors agree that intermittents in general, but particularly this dangerous kind of them, are produced by heat and moiſture. Dr Lind of Windſor remarks, that the European ſeamen are very ſubject to the fever abovementioned when they happen to arrive at Bengal in autumn. They are prediſpoſed to it from the nature of their food, their confinement on board, the very great heats to which they are expoſed during the voyage, and their lying for hours together expoſed to the night colds.

Moſt of the meat uſed by the crews of thoſe ſhips is ſalted, and often in a putrid ſtate, without any freſh vegetables, they having only biſcuits, and ſome other farinaceous matters. The quantity of the vinous or ſpirituous liquors allowed them is by far too ſmall to ſubdue the putreſcent diſpoſition of their animal-food. Their fluids conſequently become, from day to day, more and more putreſcent, and of courſe the more apt to breed and contract this diſorder. This diſpoſition is likewiſe induced by their being ſtowed very cloſe together, and that for a conſiderable length of time, and in a foul air, eſpecially when the weather happens to be too ſtormy to permit the hatches and port-holes to be kept open.

Though the heats they endure in the voyage to India are leſs conſiderable than thoſe of the country itſelf, yet they are too much for an European conſtitution

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to bear The general heat at ſea within the tropics is about 84° of Fahrenheit's thermometer, which is ſufficient to relax them, and promote a corruption of their humours, eſpecially when it coincides with the above cauſes. It likewiſe creates a languor and indolence, which alone are ſufficient to increaſe that putreſcence. Theſe cauſes are apt to be conſiderably aggravated by the mens being often exp ſed, when on duty, for hours together, to rain, damp, and cold air; a circumſtance which frequently happens to them when working their ſhips up the river Ganges in the night-time. Hence the perſpiration is checked, and the excrementitious fluid which uſed to be diſcharged by the ſkin being retained in the body, contributes, he thinks, very much towards the prediſpoſition to this diſeaſe.

But the moſt powerful of all the remote cauſes is juſtly thought to be the effluvia of marſhes replete with putrid animal-ſubſtances. We have not, however, been able to determine from what kind of putrid animal-ſubſtances theſe effluvia derive their virus. For that every kind of putrefaction has not ſuch an effect appears from this, that neither practical anatomiſts, nor thoſe who by their trades are expoſed to the putrid effluvia of animals, for inſtance ſuch tanners and butchers as keep their ſhops and ſtalls very dirty, are more ſubject than others to putrid diſeaſes. Nor are the ſhip ſtewards and their ſervants, whoſe buſineſs it is to deliver out their proviſions to the ſhips crews, and who ſpend the moſt of their time amongſt the putrid and rancid effluvia of the places in which thoſe proviſions are kept, more ſubject to putrid fevers than their ſhip-mates. But whatever be in this we are well aſſured that ſome particular putrid fermentations produce noxious vapours, which, united with thoſe of marſhes, render them more pernicious. Hence evidently proceeds the extreme unhealthfulneſs of a place called *Culpi*, on the eaſtern bank of the Ganges. The ſhores about it are full of mud, and the banks covered with trees. Oppoſite to the place where the ſhips lie there is a creek, and about a mile from its entrance ſtands the town of Culpi: the ſhips lie about a mile from the ſhore. None of the ſailors on board the ſhips ſtationed at this place enjoyed their health. The burying ground alſo contributed not a little to ſpread the infection. The ground being marſhy, the putrid water flowed from the old graves into the new ones, which infected the grave-diggers and thoſe that attended the funerals; and from this cauſe many were ſuddenly ſeized while they were performing the laſt duty to their companions. This place has ever been remarkable for the unhealthfulneſs of its air. It was once cuſtomary to ſend ſome of the Company's ſervants here to receive the cargoes of the ſhips, and ſend them to Calcutta; but ſo many of them died on this duty, that the Company was at length obliged to diſpenſe with it.

Hence it plainly appears, how apt putrid animal and vegetable ſubſtances are to render the effluvia of fenny places more pernicious than they would otherwiſe be. The reaſon why great inundations of the Nile and Ganges are followed by a healthy ſeaſon is, that by this means the putrid animal and vegetable ſubſtances diſperſed over the contiguous countries are carried off into the ſea.—The noxious vapours ariſing from fens ſpread but a little way. Dr Lind has often known ſhips crews at a very little diſtance from the ſhore quite free from this diſorder. But although theſe marſh miaſmata firſt bring on the diſeaſe, yet contagion particularly ſpreads it, and renders it more epidemic. Thus the Drake Eaſt Indiaman continued free from the diſorder for two weeks together, when ſhe had no communication with the other ſhips; whereas as ſoon as the diſorder was brought on board, many were ſeized with it within a few days in ſuch a manner as to leave no room to entertain the leaſt doubt concerning its peſtilential nature.

Tertiana.

Dr Lind of Haſlar hoſpital has given a very curious and learned account of the appearance of this fever throughout the various parts of the globe. It was very common in England in the years 1765 and 1766, one obvious cauſe of which was the prevalence of the eaſterly wind. This wind in England is often ſaid to bring with it a fog from the ſea; but the truth of the matter is, that in many places of that iſland the eaſt-wind frequently raiſes a copious vapour from water, mud, and all marſhy or damp places. To this exhaling quality of the eaſterly wind Dr Lind has often been an eye-witneſs. When the wind changes to the eaſt, the mud ſometimes ſends up a vapour as thick as ſmoke; and the doctor has obſerved two fiſh-ponds in his neighbourhood one of freſh and the other of ſalt water, which on the approach of an eaſterly wind ſometimes alſo emit a denſe vapour, as from a pot of boiling water. In order to view this phenomenon diſtinctly, the perſon ſhould ſtand at about 100 yards diſtance from the mud or ponds. If the ſun ſhines when the wind changes to the eaſt, he will obſerve a conſtant ſteam of vapours ariſing out of the ponds, from about five to ten yards in height, while the air about him remains ſerene. As the vapour or fog ariſing from other bodies glides along the ſurface of the earth, and is brought by the eaſterly wind to the ponds, he will ſtill be able, for ſome time, to diſtinguiſh the vapours aſcending perpendicularly out of the ponds from thoſe which are carried in an horizontal direction by the wind: eſpecially if the ſun continues to ſhine, though faintly.

This evaporating quality of the eaſt wind ſeems to manifeſt itſelf alſo by its effects both on the thermometer and the human body; for a thermometer hung over a damp piece of ground during the fogs or exhalations ariſing from it, will often indicate a degree of cold below the freezing point. The chillineſs of the body, ſo ſenſibly perceived when in this ſituation, ſeems to proceed from the ſame cauſe, and to produce nearly the ſame ſenſations, which the damp ariſing from the wet floor in a chamber communicates to thoſe who happen to be in it.

Winds are not conſtant in their effects. As we have ſometimes warm weather with a north-wind, and ſometimes very little heat with one blowing from the ſouth; ſo the fogs attending an eaſt-wind are not conſtant, neither is the evaporation abovementioned at all times to be perceived. It is poſſible, however, that in all this there may be a deception; and that inſtead of ſuppoſing the quantity of vapours exhaled to be increaſed by an eaſterly wind, the coldneſs of that wind may only condenſe and render viſible the vapours in the air at that time. But even this ſuppoſition is liable to great objections, as our coldeſt north-winds ſeldom or never produce ſuch an effect, but on the contrary are attended with dry and ſerene weather.

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Be this as it will, however, an eaſt-wind is uſually accompanied with a cold, damp, and unwholeſome vapour, which is obſerved to affect the health both of animals and vegetables, and in many places to produce obſtinate intermitting fevers, and alſo to occaſion frequent relapſes. In particular ſpots of the low damp iſland of Portſea, the ague frequently prevails during the autumnal ſeaſon, and in ſome years is much more frequent and violent than in others. It is alſo obſervable, that this diſeaſe always attacks ſtrangers, or thoſe who have formerly lived on a drier ſoil, and in a more elevated ſituation, with greater ſeverity than thoſe who are natives of the iſland.

The year 1765 was remarkable, not only for the long continuance of the eaſterly wind, but for an exceſſive degree of heat, which produced a more violent and general rage of thoſe diſeaſes than had been known for many years before. In the month of Auguſt the quickſilver in Fahrenheit's thermometer often roſe to 82° in the middle of the day. This conſiderable addition of heat, together with the want of refreſhing rains, greatly ſpread the fever, increaſed its violence, and even changed its form in many places. At Portſmouth, and throughout almoſt the whole iſland of Portſea, an alarming continual or remitting fever raged, which extended itſelf as far as Chicheſter. At the ſame time, the town of Goſport, though diſtant only one mile from Portſmouth, enjoyed an almoſt total exemption from ſickneſs of every kind; whereas in the neighbouring villages and farm-houſes, a mild regular tertian ague diſtreſſed whole families. The violence of the fever, with its appearances in a continued, remitting, or intermitting form, marked in ſome meaſure the nature of the ſoil. In Portſmouth the ſymptoms were bad, worſe at Kingſton, and ſtill more dangerous and violent at a place called *Half-way Houſes*; a ſtreet ſo named, about half a mile from Portſmouth, where ſcarcely one in a family eſcaped this fever, which generally made its firſt attack with a delirium. In the large ſuburb of Portſmouth called the *Common*, it ſeemed to rage with more violence than in the town, ſome parts excepted; but even whole ſtreets of this ſuburb, together with the houſes in the dock-yard, eſcaped the attack.

The Marines, who were three times a-week exerciſed early in the morning on South Sea beach, ſuffered much from the effect of the ſtagnant water in an adjoining moraſs. Half a dozen of them were frequently taken ill in their ranks when under arms; ſome being ſeized with ſuch a giddineſs of their head, that they could ſcarcely ſtand; while others fell down ſpeechleſs, and upon recovering their ſenſes complainſed of a violent head-ach. When ſuch patients were received into the hoſpital, it was obſerved that ſome few had a regular ague, but that far the greater number laboured under a remitting fever, in which ſometimes indeed there was no perceptible remiſſion for ſeveral days. A conſtant pain and giddineſs of the head were the moſt inſeparable and diſtreſſing ſymptoms of this diſeaſe. Some were delirious, and a few vomited up a quantity of bile; but in all the countenance was yellow. A long continuance of the fever produced a dropſy or jaundice, or both. Even a ſlight attack reduced the moſt robuſt conſtitution, to a ſtate of extreme debility; and this weakneſs, together with the giddineſs, continued for a long time after the fever. A ſcabby eruption now and then made its appearance on the lips and the corners of the mouth: but dry itchy ſpots over the whole body, reſembling much the common itch, and ſeeming to partake of the nature of that diſeaſe, were more frequently obſerved in the patients at Portſmouth, where there was not the leaſt reaſon to ſuſpect any infection.

Tertians.

Such is the appearance of the remitting fever occaſioned by marſh miaſmata in England. In the Netherlands its ſymptoms are not much different. Dr Wind informs us, that at Middleburg, the capital of Weſt Zealand, a ſickneſs generally reigns towards the latter end of Auguſt, or the beginning of September, which is always moſt violent after hot ſummers. It commences after the rains which fall in the end of July; the ſooner it begins the longer it continues, and it is only checked by the coldneſs of the weather. Towards the end of Auguſt and the beginning of September it is a continual burning fever, attended with a vomiting of bile, which is called the *gall ſickneſs*. This fever, after continuing three or four days, intermits, and aſſumes the form of a double tertian; leaving the patient in a fortnight, or perhaps ſooner. Strangers that have been accuſtomed to breathe a dry pure air do not recover ſo quickly. Foreigners in indigent circumſtances, ſuch as the Scots and German ſoldiers, who are garriſoned in the adjacent places, are apt after thoſe fevers to have a ſwelling in their legs and a dropſy; of which many die.

Theſe diſeaſes, the Doctor obſerves, are the ſame with the double tertians common within the tropics. Such as are ſeized with the gall-ſickneſs have at firſt ſome fluſhes of heat over the body, a loſs of appetite, a white foul tongue, a yellow tinct in the eyes, and a pale colour in the lips. Such as live well, drink wine, and have warm clothes and good lodgings, do not ſuffer ſo much during the ſickly ſeaſon as the poor people; however, theſe diſeaſes are not infectious, and ſeldom prove mortal to the natives.

Sir John Pringle obſerves, that the prevailing epidemic of autumn in all marſhy countries, is a fever of an intermitting nature, commonly of a tertian form, but of a bad kind; which, in the dampeſt places and worſt ſeaſons, appears as a double tertian, a remitting, or even an ardent fever. But however theſe fevers may vary in their appearance according to the conſtitution of the patient and other circumſtances, they are all of a ſimilar nature. For though, in the beginning of the epidemic, when the heat or rather the putrefaction in the air is the greateſt, they aſſume a continued or a remitting form, yet by the end of autumn they uſually terminate in regular intermittents.

In Zealand, where the air is more corrupted than in other parts of the Netherlands, this diſtemper, as we have already obſerved, is called the *gall-ſickneſs*; and indeed both the redundance and depravation of the gall is ſometimes ſo great, that it has been generally aſcribed to the corruption and overflowing of that humour. But though it cannot with juſtice be ſaid to originate from corrupted gall or bile, it is certain that the diſeaſe may be continued, and the ſymptoms aggravated, by an increaſed ſecretion and putrefaction of the bile occaſioned by the fever. In proportion to the coolneſs of the ſeaſon, to the height and dryneſs of the ground,

Febres. ground, this distemper is milder, remits or intermits more freely, and removes further from the nature of a continued fever. The higher ranks of people in general are least liable to the diseases of the marshes; for such countries require dry houses, apartments raised above the ground, moderate exercise, without labour in the sun or evening damps, a just quantity of fermented liquors, plenty of vegetables, and fresh meats. Without such helps, not only strangers, but the natives themselves are sickly, especially after hot and close summers. The hardiest constitutions are very little excepted more than others; and hence the British in the Netherlands have always been subject to fevers.

By this distemper the British troops were harassed throughout the whole of the war from 1743 to 1747. It appeared in the month of August 1743; the paroxysms came on in the evening, with great heat, thirst, a violent headach, and often a delirium. These symptoms lasted most of the night, but abated in the morning, with an imperfect sweat, sometimes with an hæmorrhagy of the nose or a loosness. The stomach from the beginning was disordered with a nausea and sense of oppression, frequently with a bilious and offensive vomiting. If evacuations were either neglected, or too sparingly used, the patient fell into a continued fever, and sometimes grew yellow as in a jaundice. When the season was further advanced, this fever was attended with a cough, rheumatic pains, and sizy blood. The officers being better accommodated than the common men, and the cavalry who had cloaks to keep them warm, were not so subject to it: and others who belonged to the army, but lay in quarters, were least of all affected; and the less in proportion to their being little exposed to heats, night-damps, and the other fatigues of the service.

In this manner did the remitting fever infest the army for the remaining years of the war; and that exactly in proportion to their distance from the marshy places, of which we have several notable instances in Pringle's observations. In Hungary the same disease appears with still more violence, and is readily complicated with fevers of a truly pestilential nature, by which means it becomes extremely dangerous. Hungary is acknowledged to be the most sickly climate in Europe, and indeed as bad as any in the world. Here it was where the crusaders, in only marching through the country to invade Asia, often lost half their number by sickness; and where the Austrians not long since buried, in a few years, above 40,000 of their best troops, who fell a sacrifice to the malignant disposition of the Hungarian air. The reason of this uncommon malignity is, that Hungary abounds with rivers, which, by often overflowing, leave that low flat country overspread with lakes and ponds of stagnating water, and with large unwholesome marshes. So great is the impurity of these stagnated waters, that by them the rivers, even the Danube, whose course is slow, becomes in some places corrupted and offensive. The air is moist, and in summer quite sultry. In the nights of harvest, Kramer tells us, it was so very damp, that the Austrian soldiers could not secure themselves from the moisture even by a triple tent-covering. Here epidemical distempers begin constantly to rage during the hottest months of the year; which are July, August, and September: and these complaints, according to the observations of the physician abovementioned, are the same with those which are epidemic upon the coast of Guinea, and in the sickly climates of the East and West Indies, of which malignant fevers of the remitting and intermitting kind are the the most common and dangerous. Tertian[a].

The heat of the sun in Hungary, according to the same author, is more intense than in any other country of Europe; and in proportion to the heat is the pestilential quality of the marshy exhalations. It is constantly observed, that the nearer any city or fort is to a morass or a large river with foul and oozy banks, the more unhealthy are the inhabitants. At such seasons and places, the air swarms with numberless insects and animalcules, a sure sign of its malignant disposition; and the hotter the summer, the more frequent and mortal are the diseases. In short, this country, on account of its unhealthiness, has been termed *the grave of the Germans*; and in Italy, the Campania of Rome is almost equally unhealthy. Lancisius, physician to Pope Clement XI. furnishes us with a very striking instance of the malignant quality of the air of Campania. Thirty gentlemen and ladies of the first rank in Rome having made an excursion, upon a party of pleasure, towards the mouth of the Tyber, the wind suddenly shifting blew from the south over the putrid marshes, when 29 were immediately seized with a tertian fever, only one escaping.

The island of Sardinia is annually visited with an epidemical sickness, which rages from June to September, and is called by the natives the *intemperies*. In some years there is a want of rain for four or five months; and then it is that this sickness exerts its utmost violence, being always more fatal in some places than in others, and in particular to strangers. Of this the British had a severe proof in 1758.—Admiral Broderick, in the Prince ship of war, anchored in the bay of Oristagni, where 27 of his men, sent ashore on duty, were seized with the epidemical distemper of this island; twelve of them in particular, who had slept on shore, were brought on board delirious. All of them in general laboured under a low fever, attended with great oppression at the breast and at the pit of the stomach, a constant retching, and sometimes a vomiting of bile; upon which a delirium often ensued. These fevers changed into double tertians, and terminated in obstinate quartan agues. It is worthy of remark, that in this ship, which lay only two miles from the land, none were taken ill but such as had been on shore, of whom seven died. The prior of a convent, making a visit to the English officers, informed them, that the intemperies of the island was a remitting or intermitting fever, and that he himself had suffered several attacks of it. Sardinia was formerly so remarkable for its unwholesome air, that the Romans used to banish their criminals thither; and it is at present but thinly peopled, owing to the mortality occasioned by this annual sickness. For although it is about 140 miles long, and in several places 75 miles broad, yet it is computed that the whole number of its inhabitants does not exceed 250,000: an inconsiderable number, when compared with the inhabitants of the lesser, but comparatively more healthful, island of Corsica; though even there the French lost a number of their troops by intermitting and remitting fevers.

Febres. vers. In the island of Minorca, too, Dr Cleghorn informs us, that fevers of this kind prevail exceedingly; that their types are various, their symptoms violent, the intermissions fallacious, and that they frequently and suddenly prove fatal. It is more than probable, he adds, from the accounts of several physicians and travellers, that epidemical tertians are not wholly confined to the coasts and islands of the Mediterranean, but that they are equally frequent and destructive in many other parts of the globe; and perhaps may be deemed the anniversary autumnal distempers of most hot countries in the world. And though in the mild climate of Britain, a tertian may always easily be cured when once it is discovered; yet in warm climates, such is the rapid progress of the distemper, that it is necessary to know it in the very beginning, which is very difficult for those who have never seen any but the tertians usually met with in Britain.

From Dr Cleghorn's account of Minorca, however, it doth not appear why that island should be so much infested with fevers of this kind, since it is far from being a marshy country; nay, on the contrary, it is very dry. The south wind, he observes, is very unhealthy; and it is the prevalence of this wind which brings on the fever: but still the difficulty is not removed, because the sea-air is so far from bringing on such dangerous diseases, that it is one of the greatest preservatives against them when it can be had. As to the moisture which must necessarily accompany an insular situation, that cannot reasonably be admitted as a cause of this or any other disease. In the London Medical Observations we find a paper on a subject very similar to the present, namely, the mischiefs produced by lying in damp sheets, or being exposed to moist vapour. The author tells us, that he hardly knows a distemper the origin of which hath not by some been ascribed to lying in a damp bed, or sitting in a wet room; and yet he does not know any one which will certainly be produced by these causes, and people frequently expose themselves to such causes without suffering any ill effects. "It must be owned indeed, (says he), that the vapours arising from the bilge water of ships tend to produce a scurvy. The swampy plains also near the mouths of great rivers which are often overflowed, and low grounds which cannot readily be drained, and those tracts of land where the thickness and extent of the woods keep the ground moist and half putrid for want of ventilation, are destructive to the neighbouring inhabitants, by occasioning obstinate intermittents in the colder climates, and pestilential fevers in the hotter regions. But all this mischief arises not merely from moisture, but from an unventilated and putrid moisture; for the inoffensiveness of mere wetness, untainted with putridity, may be reasonably inferred from the following considerations. The air is often fully saturated with moisture, and could not be more filled by the vapours arising from a chamber covered with water; and yet neither is any epidemical distemper produced by it, nor are those remarkably aggravated with which the sick happen at that time to be afflicted. The air from rivers and from the sea is probably more replenished with vapours than inland countries cleared of their woods: yet the most celebrated of the ancient physicians recommended the bank of a running river for the situation of a house, on account of its peculiar healthfulness; and many invalids are sent by the modern physicians to the sea side, only for the benefit of the sea air.

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"Where the sailors are cleanly, and not too much crowded, they are often as healthy during long voyages at sea, as they would have been upon any part of the land. Venice is not observed to be less healthy than London or Paris.

"Those who are much disposed to sweat, lie many hours in bed-clothes impregnated probably with a less wholesome moisture than would have been left in the sheets half-dried after washing; and I have not yet had reason to think that any remarkable injury was done to the health by the continuance of such sweats almost every night for weeks, and for months, except what arose from the too great copiousness of this evacuation.

"Children, and such as are troubled with the stone, and those who, from other infirmities or age, constantly wet their beds with their urine, do not appear to suffer in their health on this account.

"It is a common practice, in some disorders, to go to bed with the legs or arms wrapped in linen cloths thoroughly soaked in Malvern water, so that the sheets will be in many places as wet as they can be; and I have known these patients and their bedfellows receive no harm from a continuance of this practice for many months. Nor can it be said that the Malvern water is more innocent than any other water might be, on account of any ingredients with which it is impregnated; for the Malvern water is purer than that of any other spring in England which I ever examined or heard of.

"The greatest valetudinarians do not scruple to sprinkle lavender-water upon their sheets; and yet, when the spirit is flown off, there is left what is as truly water as if it had been taken from the river.

"Is it observed, that laundresses are peculiarly unhealthy above other women, though they live half their time in the midst of wet linen, in the air fully saturated with vapours? Many other employments might be mentioned, the persons occupied in which are constantly exposed to wet floors or pavements, or to be surrounded with watery vapours, or to have their clothes often wet for many hours together.

"Is it the coldness of wet linen which is to be feared? But shirts and sheets, colder than any unfrozen water can be, are safely worn and lain in by many persons, who, during a hard frost, neither warm their shirts nor their sheets.—Or does the danger lie in the dampness? But then how comes it to pass, that a warm or cold bath, and long-continued fomentations, can be used, without the destruction of those who use them? Or is it for both together? Yet we have long heard of the thickness and continuance of the cold fogs in the seas north-west of England, but have never yet been told of any certain ill effect which they have upon those that live in these countries."

With regard to the causes of fevers, however, Dr Lind is of opinion, that noxious vapours arising from the earth are for the most part to be blamed. Even in countries seemingly dry, and where violent rains are

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Febres. not frequent, he thinks that the air may load itself with putrid exhalations from the ground; and that, except in the burning desarts of Arabia or Africa, people are nowhere exempt from diseases occasioned by putrid moisture. In most of the hot countries, however, the pernicious effects of the putrid vapours are by no means equivocal. In Guinea, they seem to be more extraordinary than any where else in the world; neither indeed can it be supposed, that a hot and moist atmosphere can be without putrescency. It may in general be remarked, that in sultry climates, or during hot weather, in all places subject to great rains, where the country is not cleared and cultivated, but is over-run with thickets, shrubs, or woods, especially if there are marshes or stagnating waters in the neighbourhood, sickness may be dreaded, and particularly the remitting fever of which we now treat. The fens, even in different counties of England, are known to be very prejudicial to the health of those who live near them, and still more so to strangers; but the woody and marshy lands in hot countries are much more pernicious to the health of Europeans. In all those unhealthy places, particularly during fogs or rains, a raw vapour, disagreeable to the smell, arises from the earth, and especially in the huts or houses. But of all the vapours which infest the torrid zone, the most malignant and fatal are the *harmattans*: They are said to arise from the conflux of several rivers in the king of *Dormeo's* dominions at Benin (the most unwholesome part of Guinea), where travellers are obliged to be carried on mens backs for several days journey, through swampy grounds, and over marshes, amidst stinking ooze, and thickets of mangrove trees which are annually overflown. These vapours come up the coast to a surprising distance, with the south-east and north-east winds: and it has been observed, that in their progress they have often changed both the course of the winds and of the sea currents. The times of their appearance at Cape Coast are the months of December, January, or February. The north-east and south-east winds are always unhealthy, but particularly so during the harmattan season. Some years this vapour is scarcely perceptible; but in others it is thick, noxious, and destructive to the blacks as well as whites.—The mortality is in proportion to the density and duration of the fog. It has a raw putrid smell; and is sometimes so thick, that a person or house cannot be discerned through it, at the distance of 15 or 20 yards: and it continues so for 10 or 15 days; during which it opens the seams of ships, splits or opens the crevices of wood as if shrunk or dried with a great fire, and destroys both man and beast. In the year 1754 or 1755, the mortality occasioned in Guinea by this stinking fog was so great, that in several negro towns the living were scarce sufficient to bury the dead.—Twenty women brought over from Holland by a new governor to the Castle *del Mina*, perished, together with most of the men in the garrison. The gates of Cape Coast castle were shut up for want of centinels to do duty; the blacks dying at this time as well as the white people. It is lucky that it is only in some years that *harmattans* are so very thick and noxious, otherwise that part of the country would be depopulated. It is observed that all fogs are extremely unhealthy in those parts, particularly before and after the rainy seasons; but the above account of the *harmattans* appeared so very extraordinary and incredible to some of Dr Lind's readers, that he thought proper to publish a further corroboration of the facts abovementioned. "A gentleman (says he), who had long resided at Cape Coste castle, informed me, that during the time of this fog, being in the upper chambers of the fort, the boards of the floor shrunk so much, that he could discern the candles burning in the apartments below him (there are no plaster ceilings used in those hot countries), and that he could then even distinguish what people were doing in the apartments below; the seams of the floor having opened above half an inch, while the fog lasted which afterwards, upon its being dispelled, became close and tight as before."

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In this country the rains and dews seem to be possessed of qualities almost equally pernicious with the fogs. This much is certain, that in Guinea, many of the principal negroes, and especially of the mulattoe Portuguese, take the utmost precaution to avoid being wet with those rains, especially such as fall first. At the setting in of the rainy season, they generally shut themselves up in a close well-thatched hut, where they keep a constant fire, smoke tobacco, and drink brandy, as preservatives against the noxious quality of the air at that time. When wet by accident with the rain, they immediately plunge themselves into salt-water, if near it. Those natives generally bathe once a-day, but never in the fresh water rivers when they are overflown with the rains: at such times they prefer for that purpose the water of springs. The first rains which fall in Guinea are commonly supposed to be the most unhealthy. They have been known, in 48 hours, to render the leather of the shoes quite mouldy and rotten; they stain clothes more than any other rain; and soon after their commencement, even places formerly dry and parched swarm with frogs. At this time skins, part of the traffic of Senegal, quickly generate large worms; and it is remarked, that the fowls, which generally prey on other insects, refuse to feed on these. It has been farther observed, that woollen cloths wet in those rains, and afterwards hang up to dry in the sun, have sometimes become full of maggots in a few hours.—It is also probable, that as in some of those countries the earth, for six or eight months of the year, receives no moisture from the heavens but what falls in dews, which every night renew the vegetation, the surface of the ground in many places becomes hard and incrustated with a dry scurf, which pens up the vapours below: until by the continuance of the rains for some time, this crust is softened, and the long pent up vapours set free. That these dews do not penetrate deep into the earth is evident from the constant dryness and hardness of such spots of ground in those countries as are not covered with grass and other vegetables. Thus the large rivers in the dry season being confined within narrow bounds, leaving a great part of their channel uncovered, which having its moisture totally exhaled, becomes a solid hard crust; but no sooner the rains fall, than by degrees this long parched up crust of earth and clay gradually soften, and the ground, which before had not the left smell, begins to emit a stench, which in four or five weaks becomes exceedingly noisome, at which time the sickness is generally most violent.

This sickness, however, is not different from the remitting

Febres. remitting fever which has been described under so many various forms and names. An inflammatory fever is seldom observed, during the season of sickness, in this part of the world; and we shall conclude our description of the *amphimerina paludosa* with some extracts from the surgeon's journal of a ship that sailed up the rivers of Guinea.

"On the 5th of April we sailed up the river of Gambia, and found all the English in the fort in perfect health. The surgeons of the factory informed me, that a relaxation of the stomach, and consequently a weakened digestion, seemed to bring on most of the diseases so fatal to Europeans in the sickly season. They were generally of a bilious nature, attended with a low fever, sometimes of a malignant, at other times of a remitting kind.—On the 12th of April, after sailing 30 miles up the river St Domingo, we came to Catchou, a town belonging to the Portuguese, in Lat. 20° N. In this town were only four white people, the governor and three friars. The number of whites in the trading ships were 51. One morning, towards the latter end of April, a little rain fell. On the 13th of May there was a second shower, accompanied with a tornado. On the 18th of May it rained the whole day; and the rain continued, with but short intervals, until the beginning of October.

"In the month of June, almost two-thirds of the white people were taken ill. Their sickness could not be well characterised by any denomination commonly applied to fevers: it however approached nearest to what is called a *nervous fever*, as the pulse was always low, and the brain and nerves seemed principally affected. It had also a tendency to frequent remissions. It began sometimes with a vomiting, but oftener with a delirium. Its attack was commonly in the night; and the patients, being then delirious, were apt to run into the open air. I observed them frequently recover their senses for a short time, by means of the heavy rain which fell upon their naked bodies. But the delirium soon returned: they afterwards became comatose, their pulse sunk, and a train of nervous symptoms followed; their skin often became yellow; bilious vomitings and stools were frequent symptoms. The fever reduced the patient's strength so much, that it was generally six weeks or two months before he was able to walk abroad. A consuming flux, a jaundice, a dropsy, or obstructions in the bowels, were the consequences of it. Of 51 white men, being the companies of four ships which were at Catchou, one-third died of the fever, and one-third more of the flux, and other diseases consequent upon it; and of these not one was taken ill till the rains began.

"I believe, on the whole face of the earth, there is scarce to be found a more unhealthy country than this during the rainy season: and the idea I then conceived of our white people was by making a comparison of their breathing such a noxious air, with a number of river-fish put into stagnating water; where, as the water corrupts, the fish grow less lively, they droop, pine away, and many die.

"Thus some persons became dull, inactive, or slightly delirious, at intervals; and, without being so much as confined to their beds, they expired in that delirious and comatose state in less than 48 hours, after being in apparent good health. The white people in general became yellow; their stomach could not receive much food without loathing and retchings. Indeed it is no wonder that this sickness proved so fatal, that recoveries from it were so tedious, and that they were attended with fluxes, dropsies, the jaundice, ague-cakes, and other dangerous chronical distempers. It seemed more wonderful to me that any white people recover, while they continue to breathe so pestiferous an air as that at Catchou during the rainy season. We were, as I have already observed, 30 miles from the sea, in a country altogether uncultivated, overflowed with water, surrounded with thick impenetrable woods, and over-run with slime. The air was vitiated, noisome, and thick; insomuch that the lighted torches or candles burnt dim, and seemed ready to be extinguished; even the human voice lost its natural tone. The smell of the ground and of the houses was raw and offensive; but the vapour arising from putrid water in the ditches was much worse. All this, however, seemed tolerable, when compared with the infinite numbers of insects swarming every where, both on on the ground and in the air; which, as they seemed to be produced and cherished by the putrefaction of the atmosphere, so they contributed greatly to increase its impurity. The wild bees from the woods, together with millions of ants, over-ran and destroyed the furniture of the houses; at the same time swarms of cockroaches often darkened the air, and extinguished even candles in their flight; but the greatest plague was the musquettos and sandflies, whose incessant buzz and painful stings were more insupportable than any symptom of the fever. Besides all these, an incredible number of frogs on the banks of the river made such a constant and disagreeable croaking, that nothing but being accustomed to such an hideous noise could permit the enjoyment of natural sleep. In the beginning of October, as the rains abated, the weather became very hot; the woods were covered with abundance of dead frogs, and other vermin, left by the recess of the river; all the mangroves and shrubs were likewise overspread with stinking slime."

After so particular a description of the remitting fever in many different parts of the world, we presume it will be needless to take notice of any little varieties which may occur in the warm parts of America, as both the nature and cure of the distemper are radically the same; neither shall we lengthen out this article with further descriptions of remitting fevers from the works of foreign authors, as, from what we have already said, their nature cannot well be mistaken.

Cure. The great difficulty in the cure of remitting fevers arises from their not being simple diseases, but a complication of several others. Fevers, properly speaking, have but three or four different appearances which they can assume without a complication. One is, when they are attended with a phlogistic diathesis; another is, when they assume the form of genuine intermittents; a third is, when they produce a great debility of the nervous system; and the fourth is, when along with this debility there is also a rapid tendency to putrefaction. If, therefore, all these species happen to make an attack at once, the most dangerous fever we can imagine will be produced; and however contrary it may be to our theories to admit the possibility of such

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such an attack, the truth of the fact is too often confirmed by fatal experience. In the beginning of remittent fevers, for instance, the symptoms indicate a high degree of inflammation: but if the practitioner attempts to remove this inflammation by blood-letting or other evacuations, the pulse sinks irrecoverably, and the person dies with such symptoms as show that the nervous system has been from the beginning greatly affected; at the same time the high stimulants and cordials, or the bark, which would have conquered the nervous part of the disease, increase the inflammatory part of it to such a degree, that, by a too early exhibition of them the patient also dies, but after another manner.

In the remitting fever of the East Indies, Dr Lind of Windsor formed the following indications of cure. 1. To allay the violence of the fever. 2. To evacuate the putrid humours, and take great care to prevent the body from inclining to putrefaction. 3. To keep up the strength of the patient as much as possible during the disorder. 4. To lose no time in preventing the return of the paroxysms.

To allay the violence of the fever, every thing that can contribute to increase it ought to be carefully avoided or removed; such as great heat, too strong a light falling on the eyes, noise, and motion. If during the paroxysm the head and loins be affected with violent pains, the pulse be full and hard, and the heat intense, bleeding may be used, but with the greatest caution: for, however useful this operation may be in cold climates, the success of it in warm ones is so far from being certain, that the lives of the patients have been often very much endangered, nay even destroyed by it. Dr Badenoch, and the surgeon of the Ponsborne, endeavoured each of them to relieve two patients by blood-letting; and the consequence was that each of them lost one patient. Dr Lind bled two patients; one of whom was Mr Richardson, the first mate of the ship, who complained of a most violent pain in his head with a full hard pulse. About four or five ounces of blood were taken from him, by which he was greatly relieved: nor was the cure retarded by it; nay, the fever afterwards became less irregular. At the time the other patient was bled, the disease was exceedingly frequent and violent. He was so earnest for bleeding, that he tired all the rest with the same desire, swearing, that by refusing them this only remedy, every one of them would be sent to their graves. To quiet them, therefore, and get quit of their importunities, the Doctor complied with their request, and took about five or six ounces from him who had been the first to require it. The consequence was, that he immediately lost his strength; and in less than an hour, during which time he made his will, was carried off by the next fit. It is necessary, however, to observe, and indeed the Doctor himself makes the observation, with regard to this patient, that he was bled at an improper time, namely, between the fits, whereas, had he been bled in the hot fit, it is possible he might have been relieved.

In support of the advantages to be derived from bleeding under proper circumstances, we have the authority both of Cleghorn and Pringle. As Dr Cleghorn practised in a very hot country, his observations must in the present case have greater weight than those of Pringle, who practised in a colder one. The former acquaints us, that if he was called in early enough, unless there was a strong contra-indication, he always used to take away some blood from people of all ages; namely, from robust adults, 10 or, 12 ounces; from others a smaller quantity, in proportion to their strength and years. And further, if a violent head-ach, obstinate delirium, and great heat or pains of the bowels, were urgent, the bleeding was repeated within a day or two. By this seasonable evacuation, he found the vehemence of all the paroxysms somewhat diminished; the apyrexies became more complete; the operation of emetics and cathartics rendered safer and more successful; and the terrible symptoms which happened about the height of the distemper, such as raving *subsor*, difficulty of breathing, inflammations of the abdominal viscera, &c. were either prevented or mitigated. But if the fever had continued for some time before he was called, and the mass of blood appeared to be too much melted down or inclined to a putrid dissolution, he either abstained from bleeding entirely, or took away a very small quantity, though some importunate symptoms might seem to require a larger evacuation. As to the time of peforming the operation, he acquaints us, that it is safe enough, except when the cold fit lasts or is soon expected, or while the skin is covered with critical sweats; and that he usually opened a vein in the beginning of the hot fit; by which means the sick were relieved, the immoderate heat of the body, which is often productive of fatal effects, was diminished, and the critical sweats brought on sooner and in greater abundance.

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But though Dr Lind found venesection to be of such pernicious tendency in his patients, cooling acidulated liquors were of the utmost service, as they corrected the putrid humours, lessened the heat and thirst, and of course prevented the fever from arriving at so great an height as it would otherwise have done. Those cooling liquors are the best which are made up with some farinaceous substance, as they most easily unite with our fluids. Fossile acids too, and crystals of tartar, especially the latter, are of considerable use, not only in this but in other fevers. The neutral salts, prepared with the juice of lemons, were likewise given with success during the heat of the fever. They lessen the nausea, the fits become more regular, and the remissions more full; and they are particularly grateful when given in a state of effervescence. The good effects of these draughts we are in a great measure to ascribe to the antiseptic quality of the fixed air extricated from them during the effervescence; of which we shall speak more fully when speaking of the typhous fevers.

During the remission, it is proper to evacuate the putrid humours by small doses of ipecacuanha, or rather tartar emetic. The tartar emetic indeed appears to be endowed with some kind of febrifuge virtue, which Dr Cullen thinks is owing to its relaxing the febrile spasm taking place in the capillary vessels. But should there appear any symptoms of a topical inflammation in some of the abdominal viscera, a thing which never happens unless the disorder has been of some standing, vomiting is to be avoided, and we are to depend upon purgatives alone for the evacu-

Febres. evacuation of the putrid bile, which are always useful in the cure of this disorder. But all acrid and strong purgatives are to be carefully avoided, and only the mild antiseptic ones made use of, such as crystals of tartar, or tamarinds made up with manna or with Glauber's salt.

Under the article GALL, we have observed, from Dr Percival, the effect which vegetable acids have in sweetening putrid bile; whence it seems probable, that a liberal use of these acids would be much more serviceable than a repetition of any kind of purgatives. Though in these diseases there is a great quantity of putrescent bile collected in the body, yet it seems much more probable that this is the *effect* rather than the *cause* of the disorder; and therefore, though we carry off the quantity collected ever so often, more of the same kind will still be produced by the putrescent disposition of the other fluids, at the same time that the strength of the patient must necessarily be diminished by repeated evacuations, when it ought rather to be kept up by all possible means. We ought well to observe, however, that the mineral acids have not that property of sweetening putrid bile which the vegetable ones have; and therefore the same relief will not be given by them which might reasonably be expected from vinegar or lemon-juice.

In order to keep up the strength of the patient, good food is absolutely necessary. Dr Lind allowed the sick small messes of panada made with boiled rice and barley mixed with currants or raisins and prunes, seasoned with sugar and a little wine, especially claret. During the paroxysms, they had gruel made of flour and rice, with sugar and the juice of acid fruit; and when the fit went off, a little wine was added to this mixture.

The shirts and bedding must be very often changed and well aired; their stools, and all filth and nastiness, are to be immediately removed; the places where they are lodged should be well aired and frequently sprinkled with vinegar; and, in the last place, the sick must be exceedingly well nursed. Blisters, according to Dr Lind, should never be used till the fever has been of long continuance, or the spirits and pulse of the patient have begun to flag. But here our author has implicitly followed Dr Huxham, whose theory concerning the use of blisters is now found to be erroneous. According to that celebrated author, blisters are capable of doing considerable hurt in all cases where there is a tendency to inflammation, by increasing the motion of the fluids and the oscillatory power of the vessels, both of which are already too great. They are also improper, according to him, where there is a considerable tendency of the fluids to putrefaction; because he supposes the salts of these flies to operate in the same manner with volatile alkalies, that is, by dissolving and putrefying the blood still farther. But Sir John Pringle has shown, that, in inflammatory fevers as well as those of the putrid kind, both blisters and volatile salts may be of service; the latter, particularly, he hath experimentally proved to be so far from promoting putrefaction, that they are exceedingly strong antiseptics.

In the East Indies, Dr Lind found it absolutely necessary to exhibit the bark in large quantities, and as early as possible. By this method he not only secured the patient from the imminent danger of death to which he was exposed at every fit, but likewise conquered those obstructions which were apt to ensue in the abdominal viscera, and which are to be attributed to the continuance of the disorder, and not to the bark employed to cure it. He always gave the bark during the second remission, as all his care was during the first to cleanse the primæ viæ. He observes, however, that it is to no purpose to give the bark till the necessary purgations are over; but assures us, that it never fails, unless from the coming on of a vomiting or diarrhœa it cannot be taken in sufficient quantities before the return of a paroxysm. To prevent the medicine from vomiting or purging, he mixed a few drops of liquid laudanum with every dose of it. Half a drachm was given every half hour in some convenient vehicle, beginning as soon as the fever had considerably abated, and the pulse was returned nearly to its natural state; both which generally happened before the sweats were over. An ounce of the bark was sometimes found too little to check the fever, but an ounce and a half never failed. It must be continued daily in small doses till the patient has recovered his strength, and then a greater quantity must be given, especially at the season when the rivers overflow the country. Tertiana.

Dr Pringle found the autumnal remittents in the Netherlands complicated with a great many inflammatory symptoms; for which reason it was generally found necessary to open a vein in the beginning. The vernal and later autumnal remitting fevers are accompanied with pleuritic and rheumatic pains from the coldness of the weather, and on that account require more bleeding. A physician unacquainted with the nature of the disease, and attending chiefly to the paroxysms and remission would be apt to omit this evacuation entirely, and give the bark too soon, which would bring on a continued inflammatory fever. In these countries a vein may be safely opened either during the remission or in the height of a paroxysm; and our author also found good effects resulting from bleeding in the hot fits of the marsh-fever, even after it had almost come to regular intermissions. After bleeding a purgative was usually exhibited, of which he gives us the following formula.

R. Infusi senæ commun. ℥iij.
Elect. Lenitiv. ℥ss.
Nitr. pur. ʒi
Tinct. sen. ʒvi. M.

Of this only one half was taken at once: and if it did not operate twice in four hours, the remainder was then taken. This potion agreed with the stomach, purged plentifully, and therefore was a very useful composition. Next morning, when there was almost always some remission, he gave one grain of emetic tartar rubbed with 12 grains of crabs-eyes, and repeated the dose in two hours, if the first had little or no effect; or at any rate in four hours. This medicine was intended not only to vomit, but also to operate by stool, and excite a sweat. If these evacuations were procured, the fever generally became easier, and was even sometimes cured. This he prefers to the ipecacuanha, and therefore in the latter years of his practice disused that root entirely. The same medicine was repeated next day or the day following; or if not,

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not, a laxative clyſter was thrown in: and this method was continued till the fever either went off altogether, or intermitted in ſuch a manner as to be cured by the bark.

A ſimilar method was followed by Dr Huck in the remitting fevers of the Weſt Indies and North America. In the beginning he let blood; and in the firſt remiſſion gave four or five grains of ipecacuanha, with from half a grain to two grains of emetic tartar. This powder he repeated in two hours, taking care that the patient ſhould not drink before the ſecond doſe; for then the medicine more readily paſſed into the bowels after it had operated by vomiting. If after two hours more the operation either way was ſmall, he gave a third doſe, which commonly had a good effect in opening the firſt paſſages; and then the fever either went quite off, or intermitted in ſuch a manner as to yield to the bark. On the continent, he found little difficulty after the intermiſſion; but in the Weſt Indies, unleſs he gave the bark upon the very firſt intermiſſion, though imperfect, the fever was apt to aſſume a continued and dangerous form.

In the remitting fevers of hot countries, however, it muſt be obſerved, that the lancet muſt in all caſes be much more ſparingly uſed than in ſimilar diſeaſes of the colder regions; and we muſt alſo be ſparing of veneſection in thoſe countries where the marſh effluvia are very ſtrong and prevail much. For this reaſon Dr Lind of Haſlar greatly condemns the practice of indiſcriminate bleeding when people firſt arrive in hot climates. The firſt diſeaſes indeed which occur in a voyage to the ſouthward are for the moſt part of an inflammatory nature, and owing to a ſudden tranſition from cold to hot weather. This occaſions a fullneſs and diſtenſion of the veſſels; whence all Europeans, on their firſt arrival under the tropic, bear evacuations much better than afterwards. The practice of indiſcriminately bleeding, however, a number of the ſhip's company when they firſt come into a warm latitude, is by no means found to anſwer the purpoſe of a preventive. In ſuch caſes, indeed, as plainly indicate a plethoric diſpoſition brought on by the heat, blood-letting is certainly uſeful. The ſigns of this are a pain and giddineſs in the head; a heavineſs and dulneſs of the eyes, which ſometimes appear ſlightly inflamed: there is alſo commonly a ſenſe of weight and fulneſs in the breaſt, the pulſe at the ſame time being quick and oppreſſed.

But the caſe is quite different after a longer continuance of ſultry weather, and when the conſtitution is in ſome meaſure habituated to the hot climate. For it is then obſerved, that the ſymptoms of inflammations in the bowels, even the moſt dangerous, are not near ſo ſevere in ſuch climates as in cold countries; nor can the patients bear ſuch large evacuations. The phyſician, however, muſt take care not to be miſled by the apparent mildneſs of the ſymptoms: for he will find, notwithſtanding ſuch deceitful appearances, that the inflammation makes a more rapid progreſs in hot countries than in cold, ſuppurations and mortifications being much more ſuddenly formed; and that in general all acute diſtempers come ſooner to a criſis in the warm ſouthern than in colder regions. Hence it is an important rule of practice in thoſe climates, to ſeize the moſt early opportunity, in the commencement of all threatening inflammations, to make frequent though not copious evacuations by blood-letting. For by delay the inflammation quickly paſſes from its firſt to its laſt or fatal ſtage; at leaſt an imperfect criſis in ſuch inflammatory fevers enſues, which fixes an obſtruction in the viſcera extremely difficult to remove.

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It is indeed a general maxim with ſome phyſicians in the Weſt Indies, that in moſt acute diſtempers bleeding in that country is prejudicial. This is founded upon a ſuppoſition that the craſſamentum of the blood is thinned, and the ſolids greatly weakened, by the heat of the climate. It is therefore objected, that bleeding in ſuch an habit of body weakens the powers of nature, and withdraws the ſtrength which is requiſite to ſupport the patient until the criſis of the fever.

This reaſoning is partly juſt; but, like all general maxims, will admit of exceptions. Firſt with regard to ſailors, it is to be remembered, that they are more expoſed to quick viciſſitudes of heat, cold, damps, and to various changes of the air and weather, than moſt of the other inhabitants of the Torrid Zone. Add to this, that their intemperance, and the exceſſes they are apt to fall into whenever it is in their power to commit them, render them more liable to inflammations than any other ſet of people. Hence their diſeaſes require more plentiful evacuations than the land-inhabitants of thoſe parts of the world, and generally they bear them better. But with regard to the natives of the country, or thoſe who have remained long there, it muſt be proper to bleed them very ſparingly, making a ſmall allowance for the different ſeaſons of the year, the temperature of the air, and the ſituation of the places where they reſide. Thus, in ſome parts, even on the iſland of Jamaica, at particular ſeaſons, the weather is cool; wherefore, in theſe places, and at ſuch ſeaſons, the inhabitants having their fibres more rigid, and a firmer craſis of their blood, bear veneſection much better.

In cold countries the ſtate of the air greatly aſſiſts in reſtoring the impaired ſpring of the fibres; whereas every thing almoſt in warm weather, ſuch as heat, moiſture, &c. concur to relax and weaken the habit of body. Thus we may daily ſee perſons in Britain, after having ſuffered a moſt ſevere fit of ſickneſs, recover their ſtrength and ſpirits in a few days, and in a very ſhort time their natural conſtitution. But the caſe is very different in the ſultry regions of the Torrid Zone, or indeed in any part of the world where the heat of the ſeaſon cauſes the mercury to ſtand for any length of time at the 77th degree and upward of Fahrenheit's thermometer. During ſuch an exceſs of heat, debility after fevers is apt to remain with European conſtitutions for ſeveral months. In Jamaica, the convaleſcents are ſent to the cool ſummits of the mountains; but a retreat to a more northern climate is often abſolutely neceſſary to recover their wonted tone and vigour of body. It is a well-eſtabliſhed obſervation, that the negroes and aborigines of the Torrid Zone cannot bear plentiful evacuations by the lancet. They commonly mix the moſt ſtimulating poignant ſpices with their ordinary light food, and this is found by experience ſuitable to their conſtitutions.

As proper preventives for the dangerous fevers of

Febres. which we are treating, Dr Lind on all occasions recommends the avoiding of stagnant water, or putrid marshes; the use of proper food, cleanliness, and sobriety. Of the propriety of removing from the neighbourhood of those places whose pestilential effluvia produce the disorders, we cannot possibly entertain a doubt; and of the efficacy of proper food in preventing putrid disorders he gives a remarkable instance in the Sheerness man of war, bound to the East Indies. As they went out, the men being apprehensive of sickness in so long a voyage, petitioned the captain not to oblige them to take up their salt provisions, but rather to permit them to live upon the other species of their allowance. It was therefore ordered, that they should be served with salt-meat only once a-weak; and the consequence was, that, after a passage of five months and one day, the ship arrived at the Cape of Good Hope without having a single person sick on board. As the use of Sutton's pipes had been then newly introduced into the king's ships, the captain was willing to ascribe part of such an uncommon healthfulness to their beneficial effects; but it was soon discovered, that, by the neglect of the carpenter, the cock of the pipes had been all this while kept shut. This ship remained in India some months, where none of the men, except the boat's crew, had the benefit of going on shore; notwithstanding which, the crew continued to enjoy the most perfect state of health; they were, however, well supplied with fresh meat. On leaving India, knowing they were to stop at the Cape of Good Hope, and trusting to a quick passage, and the abundance of refreshments to be had there, they eat their full allowance of salt-meats, during a passage of only 10 weeks; and it is to be remarked the air-pipes were now open. The effect of this was, that when they were arrived at the Cape, 20 of them were afflicted in a most miserable manner with scorbutic and other disorders. These, however, were speedily recovered by the refreshments they met with on shore. Being now thoroughly sensible of the beneficial effects of eating, in these southern climates, as little salt meat as possible when at sea, they unanimously agreed, in their voyage home from the Cape, to refrain from their too plentiful allowance of salt flesh. And thus the Sheerness arrived at Spithead, with her full complement of 160 men in perfect health and with unbroken constitutions; having in this voyage of 14 months and 15 days buried but one man, who died in a mercurial salivation.

Thus we see, that a free and pure air is not a sufficient preservative against a putrescent state of the fluids, without proper food; and, on the other hand, we have a very remarkable instance of the inefficacy of the most salutary food to prevent putrid diseases, in a very noxious state of the atmosphere. In the year 1717, at the siege of Belgrade in Hungary, the fever of the country, and the flux, occasioned a most extraordinary mortality among the troops. The dread of these diseases caused every one, as may naturally be supposed, to have recourse to different precautions for self-preservation. Prince Eugene, the commander in chief, had water and the provisions for his table sent him twice a-week from Vienna. The pure stream of the river Kahlenberg was regularly brought to him: he avoided all excesses, and lived regularly, or rather abstemiously; refreshed himself often by eating a cool melon; and mixed his usual wine, which was Burgundy, with water. Yet notwithstanding his utmost care, he was seized with a dysentery; which would have quickly put an end to his life, had not the speedy conclusion of that campaign permitted him to make a quick retreat. Quartana.

At this unhealthy season, when hardly one imperial officer, much less their several domestics, escaped those malignant diseases, the renowned Count Bonneval and his numerous retinue continued in perfect health, to the surprise, or, to use the words of Dr Kramer, to the *envy*, of all who beheld him. The only precaution he used was to take, two or three times a-day, a small quantity of brandy in which the bark was infused; and he obliged all his attendants and domestics to follow his example. It is no less remarkable that the count, placing his certain preservation in the use of this single medicine, lived for many years afterwards in the most unhealthy spots of Hungary, without any attack or apprehension of disease; and continued to enjoy a perfect state of health during the hottest and most sickly seasons. And thus, with an unbroken and sound constitution, which is seldom the case of those who reside long in such climates, he lived to a great age. There is an instance produced by the same author of a whole regiment in Italy having been preserved by the use of the bark from the attack of these malignant diseases, viz. the flux, and *lilious* fever as it is frequently called, when the rest of the Austrian army, not pursuing that method, became greatly annoyed with them.

The intemperance and irregular living of those Europeans who visit the hot climates is frequently accused as the cause of their destruction; but, our author thinks, without sufficient reason: for though intemperance will make the body more liable to receive such diseases, it will not bring them on. It must by no means, however, be imagined, that in these climates Europeans may with impunity be guilty of excesses in eating or drinking; for the least error in that way will often prove fatal by debilitating the body, whose utmost strength in time of full health was perhaps scarce sufficient to resist the pestilential miasmata of the atmosphere.

It appears, therefore, from the concurrent testimony of the most eminent physicians, that the most proper medicine to be used, either as a preventive or cure for remitting and intermitting disorders is the Peruvian bark, administered with proper precautions, and after the *primæ viæ* have been evacuted of the putrid bilious matter collected in them. In those species of *tritæophya*, &c. belonging to this class, enumerated by Sauvages, the same remedies only were useful; but in that pestilential distemper which he calls *tritæophya Vratislaviensis*, he tells us, that washing the body with water sometimes hot sometimes cold, watery clysters, and plenty of aqueous drink, were likewise of use.

Genus II. QUARTANA; the Quartan Fever. 153

Quartana auctorum, *Sauv.* Gen. 89. *Lin.* 17. *Vog.* 3. *Sag.* 711. *Hoffm.* II. p. 23. *Junck.* tab. 81.

The *Genuine* Quartan. Sp. I. var. 1. A.

Quartana legitima, *Sauv.* sp. 1. *Sydenham* de morb. acut. cap. v.

Description

Febres. *Description.* The genuine quartan, according to Juncker, keeps its form more exactly than other intermittents; scarcely coming on at any other time than four or five in the afternoon. The cold is less violent than in the tertian; but is very perceptible, though it doth not proceed to such a height as to make the limbs shake; and continues for about two hours. It is preceded and accompanied by a langour both of body and mind. There is seldom any vomiting unless when the stomach is manifestly overloaded with aliment; neither is their any diarrhœa, but the belly in general is rather bound, not only on the days on which the paroxysm takes place, but also on the intermediate ones. The heat, which slowly succeeds the cold, is less troublesome to the patient by its violence than by the uneasy dryness of the skin, which is scarce ever moistened with sweat. This heat rarely continues longer than four or six hours, unless perhaps at the first or second paroxysm. It is accompanied also with a giddiness and dull pain of the head. On the termination of the paroxysm, the patient returns to a middling state of health, and continues in the same for the rest of the intermediate days; only there remains somewhat of a loathing, and a deep-seated pain as if the person was all over bruised or broken, which kind of sensation the physicians are wont to call *osteocopus*. The fit returns every fourth day, and that precisely at the same hours, being rarely postponed.

Causes of, and persons subject to, this Disorder. The same general causes concur in producing this as in other intermittents, namely marsh miasmata, and whatever can dispose the body to be easily affected by them. Studious people, and those of a melancholic turn, are said to be particularly subject to quartans; but what are the immediate causes which produce a return of the fits every fourth day, instead of every day, or every third day, must probably lie for ever concealed, as depending upon the secret and inexplicable mechanism of the human body.

Prognosis. A simple quartan, where there is no reason to dread any induration of the viscera, may very certainly admit of a cure; and the prognosis can never be unfavourable, unless in cases of extreme weakness, or where the distemper hath been unskilfully treated.

Cure. This does not in the least differ from that which hath been fully laid down for the simple tertian, and which it is needless therefore to repeat here.

The *Duplicated* QUARTAN. Sp. I. var. 1. B.

154 Quartana duplicata, *Sauv.* sp. 4. *Bonet.*

This is entirely similar to the duplicated tertian already mentioned; proper allowance being made for the difference between the type of a tertian and quartan.

The *Triplicated* QUARTAN. Sp. I. var. 1. C.

155 Quartan triplicata, *Sauv.* sp. 16.

This hath three paroxysms every fourth day, while the intermediate days are entirely free from fever.

The *Double* QUARTAN. sp. I. var. 1. D.

156 Quartana duplex, Sauv sp. 3, *Vog.* sp. 13.

In the double quartan, the fits come on every day except the third; but so that the first paroxysm answers to the third, the second to the fourth, and so on.

The *Triple* QUARTAN. Sp. I. var. 1. E. Quartana.

Quartana triplex, *Sauv.* sp. 5. *Vog.* sp. 14. *Bartholin.* H. anat. c. 1. 95. 157

This comes on every day, but the quartan type is still preserved by the times of accession; that is, the time of the fourth paroxysm's coming on answers to that of the first, the fifth to the second, the sixth to the third, &c.

The QUARTAN, accompanied with *Symptoms* of other diseases. Sp. I. var. 2.

Quartana cataleptica, *Sauv.* sp. 7. *Bonet.* polyalth. vol. 1. p. 805. 158

Quartana comatosa, *Sauv.* sp. 15. *Werlhof.* de febr. *C. Pisonis* Observ. de morbis a colluvia serof. obs. 166, 167, 168, 169, 171, 172, 173, 174.

Quartana epileptica, *Sauv.* sp. 8. *Scholzii* Cons. 379, 380.

Quartana hysterica, *Sauv.* sp. 10. *Morton*, Pyret. exerc. 1. cap. ix. H. 10, 11.

Quartana nephralgica, *Sauv.* sp. 9.

Quartana metastatica, *Sauv.* sp. 17.

Quartana amens, *Sauv.* sp. 12. *Sydenham* de morb. acut. cap. v.

Quartana splenetica, *Sauv.* sp. 2. *Etmuller*, Coll. consult. cas. 25.

The QUARTAN *complicated* with other *Diseases*. Sp. I. var. 3.

Quartana syphilitica, *Sauv.* sp. 6. *Plateri*, observ. L. III. p. 676. Edin. Ess. art. xlvii. obs. 8. 159

Quartana arthriticia, *Sauv.* sp. 11. *Musgr. de Arthr.* symp. cap. ix. H. 4. et 5.

Arthritis febrisequa, *Sauv.* sp. 10.

Arthritis febricosa, *Sauv.* sp. 10. *Werlhof.* de febr. *Cockburn* de morbis navigantium, obs. 19.

Quartana scorbutica, *Sauv.* sp. 14. *Barthol.* de med. Dan. diss. iv. *Tim.* L. VIII. cas. 18.

The *Remitting* QUARTAN. Sp. II.

Tetartophya. *Sauv.* gen. 85. *Sag.* 699. *Lin.* 21.

Quartana remittens auctorum. 160

Var. 1. Tetartophya simplex, *Sauv.* sp. 1.
2. Amphimerina semiquartana, *Sauv.* sp. 23.
3. Tetartophya semitertiana, *Sauv.* sp. 5.
4. Tetartophya maligna, *Sauv.* sp. 6. *Lautter.* Hist. med. cas. 21. *M. Donat.* L. III. cap. 14. ex. *M. Gatenaria Horst.* L. I. obs. 15.
5. Tetartophya carotica, *Sauv.* sp. 4. *Werlhof.* de febr. *Bianchi* Hist. hep. pars III. const. ann. 1718, p. 751.
6. Tetartophya splenalgica, *Sauv.* sp. 2.
7. Tetartophya, hepatalgica, *Sauv.* 3. *Car. Pis.* in prefat. p. 33.
8. Amphimerina spasmodica, *Sauv.* sp. 16.

To the tertian or quartan fevers also belong the *Erraticæ* of authors. As all those abovementioned differ only in the slight circumstance of the type from the intermitting and remitting tertians already described at length, it is unnecessary here to take up time in describing every minute circumstance related by physicians concerning them, especially as it could contribute nothing towards the laying down a better method of cure than what hath been already suggested.

GENUS

GENUS III. QUOTIDIANA; the QUOTIDIAN FEVER.

Quotidiana auctorum, *Sauv.* gen. 86. *Lin.* 15. *Vog.* I. *Hoffm.* II. 33. *Junck.* tab. 79.

161 The *Genuine* QUOTIDIAN. Sp. 1. var. 1. A.
Quotidiana simplex, *Sauv.* sp. 1.
Quotidiana legitima, *Sennert.* de febr. cap. 18.

Description. This kind of fever generally comes on about six or seven o'clock in the morning, beginning with a considerable degree of cold and shivering, which lasts for about an hour; and is often accompanied with vomiting, or spontaneous diarrhœa, or both. It is succeeded by a pretty strong heat, accompanied with thirst, restlessness, and pain of the head. When the heat abates a little, a spontaneous sweat commonly follows, and the whole paroxysm rarely exceeds six hours. It returns, however, every day almost always at the same hour, unless it be evidently disturbed.

Causes of, and persons subject to, the disease. The same general causes are to be assigned for the quotidian as for other intermittents. This kind occurs but rarely; and is said to attack people of a phlegmatic temperament rather than any other; also old people rather than young, and women rather than men.

The prognosis and method of cure are not different from those of tertians and quartans.

162 The *Partial* Quotidian. Sp. 1. var. 1. B.
Quotidiana partialis, *Sauv.* sp. 16. *Cnoffel*, E. N. C. D. 1. A. III. obs. 205. Edin. Med. Ess. vol. 1. art. 31. vol. ii. art. 16.
Quotidiana cephalalgica, *Sauv.* sp. 6. *Mort.* pyretol. exerc. i. hist. 27. *Van Swieten in Boerh.* p. 534.
Cephalalgia intermittens, *Sauv.* sp. 7.
Cephalæa febricosa, *Sauv.* sp. 4.
Quotidiana ophthalmica, *Morton*, ibid. hist. 17. *Van Swieten*, ibid.
Ophthalmia febricosa, *Sauv.* sp. 23.

These distempers attack only some particular part of the body, as the head, the eye, arm, &c. producing periodical affections of those parts returning once in 24 hours; and are to be cured by the bark, as other intermittents. They are known to belong to this class, by the evident intermission of the pain or other affection of the part. The *quotidiana hysterica*, *Sauv.* sp. 3. *quotidiana catarrhalis*, *Sauv.* sp. 9, and *quotidiana strangurioſa*, *Sauv.* sp. 11. seem to be symptomatic disorders.

The *Remitting* QUOTIDIAN. Sp. II.
113 Amphimerina, *Sauv.* gen. 84. *Lin.* 20.
Quotidiana continua, *Vog.* 15.
Quotidianæ remittentes et continuæ auctorum.
Amphimerina latica, *Sauv.* sp. 1.
Febris continua, lymphatica, *Etmuller*, Coll. conf. cas. 32. *River.* Obs. cent. 1. obs. 57.
Amphimerina singultuosa, *Sauv.* sp. 14.
Febris continua Lyngodes, *Vog.* 26.

Concerning these also nothing remains necessary to be mentioned in this place, having already so fully discussed the remitting fevers in all the different parts of the world. Many other varieties of these fevers mentioned by different authors are to be accounted merely symptomatic.

SECT. II. CONTINUED FEVERS.

Continuæ, *Sauv.* class ii. ord. 1. *Vog.* class I. ord. 2. *Sag.* 666. *Boerh.* 727.
Continentes, *Lin.* class. ii. ord. 1. *Stahl.* Cas. mag. 35. Cas. min. 87. *Junck.* 58. *Sennert.* de febr. L. ii. cap. 2. et 10.

GENUS IV. SYNOCHA.

Synocha, *Sauv.* gen. 80. *Lin.* 12. *Junck.* 58. 164
Synocha, sive febris acuta sanguinea, *Hoffm.* II. 105.
Synochus, *Vog.* 16.
Continua non putris, *Boerh.* 720.
Ephemera, *Sauv.* g. 79. *Boerh.* 728. *Junck.* 57.
Diaria, *Lin.* 11.
Febris inflammatoria auctorum.

Description. The most simple kind of synocha is the ephemera or diary fever. It begins without any sensation of cold or shivering, unless there be some internal inflammation, or the small-pox or measles happen to be present. A continual heat without any intermission constitutes the essence of this disease. The heat, however, is more tolerable than in the synocha properly so called. In some the pains of the head are pungent and throbbing, answering to the pulsations of the arteries; but in others they are dull and heavy. The face is red and bloated; and there is a remarkable lassitude of the limbs, with a strong, full, and frequent pulse. The urine is red, and deposits a sediment almost of the colour of orange-peel; and in the very first day of the disease, signs of concoction (according to the Hippocratic phrase) appear. The fever commonly goes off with a gentle sweat, but sometimes, though more rarely, with an hemorrhagy of the nose. Its shortest period is 24 hours; but if it goes beyond the fourth day, it is then a *synocha* properly so called.

The simple synocha, according to Vogel, begins with cold and shivering, succeeded by vehement heat, redness, and dryness of the skin. The face, especially, is very red, and the thirst intense. The head is either pained or heavy. The patient either doth not sleep at all, or is disturbed with dreams. A moist sweat then breaks out all over the skin. The pulse is full, quick, and frequent; the judgment is sometimes a little disturbed: young people are apt to be terrified with imaginations; and they for the most part incline to sleep: the respiration is difficult, and the belly costive; at the same time that a tensive kind of lassitude is perceived over the whole body. A complete crisis takes place either on the fourth or at the farthest on the eleventh day. The characteristic marks of the simple synochus, therefore, are, A redness of the face, moisture of the skin, a strong and frequent pulse.

Causes of, and persons subject to, this disease. As we have already remarked of intermittents, so must we also now remark of continued fevers, that it is impossible to discover those minute causes which occasion the difference of type betwixt one inflammatory fever and another, though most authors pretend to enumerate these with great certainty. Thus Juncker tells us, that the cause of the simple ephemera is plethora, together with any immoderate agitation and commotion of the fluids while in that state. Vogel reckons among the causes of his *febres diaria*, passions of the mind, pain, want, exposure to the sun &c.; a repulsion or absorption

of

Febres. of certain humours; wounds, fractures, luxations, &c.; so that in general we may reckon every thing tending to increase the action of the arterial system to be in certain circumstances a cause of inflammatory fever.—Hence we find those are most subject to the synocha whose constitution is either naturally robust, or who are exposed to those cause which tend to produce an increased action of the arterial system; such as hard labour, high living, &c.

Prognosis. The most simple kind of synocha, that is, the ephemera or diary fever, is commonly cured without the assistance of medicine, and therefore the prognosis is for the most part favourable: yet, if it be improperly treated by heating medicines, it may easily be converted into the other kind; or, if there be a putrid disposition of the fluids, into a fever of a very dangerous nature. The same thing is to be understood even of the most violent kind; for simple inflammatory fevers are not dangerous unless complicated with an affection of some particular part, as the pleura, stomach, &c.

Cure. Dr Cullen objects to the plan of those who are for leaving the cure of continued fevers to the operations of nature; because these operations are neither certain in themselves, nor are they so well understood as to enable us to regulate them properly; and it is likewise possible to supersede them by art. The plan therefore on which he proceeds is, to form his indications of cure upon the means of obviating the tendency to death in fevers; and these he reduces to three. 1. To moderate the violence of re-action.—2. To remove or obviate the causes of debility; and, 3. To obviate or correct the tendency of the fluids to putrefaction.

The *first* indication may be answered, 1. By all those means which diminish the action of the heart and arteries. 2. By those which take off the spasm of the extreme vessels, which, according to his theory, is the chief cause of violent re-action.

I. The action of the heart and arteries may be diminished, 1. By avoiding or moderating those irritations which, in one degree or other, are almost constantly applied to the body. 2. By the use of certain sedative powers. 3. By diminishing the tension or tone of the arterial system.

[1.] The irritations abovementioned are the impressions made upon our senses, the exercise of the body and mind, and the taking in of aliments. The avoiding of these as much as possible, or the moderating their force, makes what is properly called the *antiphlogistic regimen*, proper to be employed in *almost* every continued fever. This regimen is to be directed in the following manner.

1. Impressions on the external senses, as stimulant to the system, and a chief support of its activity, should be avoided as much as possible; especially such as are of a stronger kind, and which give pain and uneasiness. No impression is to be more carefully guarded against than that of external heat; and at the same time every other means of increasing the heat of the body is to be shunned. Both these precautions are to be taken as soon as a hot stage is fully formed, and to be attended to during its continuance, except in certain cases, where a determination to sweating is necessary, or where the stimulant effects of heat may be compensated by circumstances which determine it to produce a relaxation and revulsion. Synocha.

2. All motion of the body is to be avoided as much as possible, and that posture only chosen which employs the fewest muscles, and keeps none of them long in a state of contraction. Speaking, as it accelerates respiration, is particularly to be avoided. It must also be observed, that every motion of the body is more stimulant in proportion as the patient is weaker.

3. The exercise of the mind is also to be avoided, as being a stimulus to the body; but here an exception is to be made in the case of a delirium coming on, when the presenting of accustomed objects may divert the irregular train of ideas then arising in the mind.

4. The presence of recent aliment in the stomach proves always a stimulus to the system, and ought therefore to be as moderate as possible. A total abstinence for some time may be of service; but as this cannot be long continued with safety, we must avoid the stimulus of aliment by choosing that kind which gives the least. Alimentary matters are also to be accounted more stimulant in proportion to their alkalescent qualities; and this leads us to avoid all animal, and use only vegetable food. For the same reason, aromatic and spirituous liquors are to be avoided; and in answering the present indication, we must abstain from all fermented liquors except those of the lowest quality. Other stimuli are, the sensation of thirst, crudities or corrupted humours in the stomach, a preternatural retention of the fæces in the intestines, and a general acrimony of all the humours, which is in most fevers to be suspected. These are to be removed by such methods as the urgency of the symptoms require, by diluting liquors, vomiting, the use of acids, laxative clysters, and large quantities of antiseptic drinks.

[2.] The second method of moderating the violence of reaction is by the employment of certain sedative powers, with a view to diminish the activity of the whole body, and particularly that of the sanguiferous system. The first of these to be mentioned is the application of cold. Heat is the chief support of the activity of the animal-system; and the system is therefore provided with a power of generating heat in itself: but at the same time we may observe, that this would go to excess, were it not constantly moderated be a cooler temperature in the surrounding atmosphere. When, therefore, the generating power of heat in the system is increased, as is commonly the case in fevers, it is necessary not only to avoid all further means of increasing it, but also to apply air of a cooler temperature; or at least to apply it more entirely and freely than in a state of health. This is shown, from some late observations, to be a very powerful means of moderating the violence of reaction; but what is the mode of its operation, to what circumstances of fever it particularly applies, or what limitations it requires, are not yet fully ascertained.

Another sedative power very frequently employed in fevers, is that of certain medicines known in the materia medica by the name of *refrigerants*. The chief of these are acids of all kinds when sufficiently diluted, and which are, in several respects, remedies adapted to continued fevers. Those especially in use are

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are the vitriolic and vegetable; and on many accounts the latter are to be preferred. Another set of refrigerants are the neutral salts formed of the vitriolic, nitrous, or vegetable acids, with alkalies either fixed or volatile. All these neutrals, while they are dissolved in water, generate cold: but as that cold ceases soon after the dissolution is finished, and as the salts are generally exhibited in a dissolved state, their refrigerant power in the animal body does not all depend upon their power of generating cold with water. Nitre is the refrigerant chiefly employed; but all the others, compounded as abovementioned, partake more or less of the same quality. Besides these neutrals, some metallic salts have also been employed in fevers, particularly the sugar of lead: but the refrigerant powers of this salt are by no means ascertained, and its deleterious qualities are too well known to admit of its being freely used.

[3.] The third general method of diminishing the reaction of the system, is by lessening the tension, tone, and activity of the sanguiferous system. As the activity of the system in a great measure depends upon the tone, and this again upon the tension, of the vessels, given to them by the quantity of fluids they contain, it is evident, that the diminution of the quantity of these must diminish the activity of the sanguiferous system. The most efficacious means of diminishing the quantity of fluids is by the evacuations of blood-letting and purging. The former is evidently one of the most powerful means of diminishing the activity of the whole body, and especially of the sanguiferous system; and it must therefore be the most effectual means of moderating the reaction in fevers. When the violence of reaction, and its constant attendant a phlogistic diathesis, are sufficiently evident; when these constitute the principal part of the disease, and may be expected to continue through the whole of it, as in the cases of synocha; then blood-letting is the principal remedy, and may be employed as far as the symptoms of the disease may seem to require, and the constitution of the patient will bear. It must, however, be remarked, that a greater evacuation than is necessary may occasion a slower recovery, and render the person more liable to a relapse, or bring on other diseases. It is also to be observed, that this evacuation is the more effectual, as the blood is more suddenly drawn off, and as the body is at the same time more free from all irritation, and therefore when it is in a posture in which the fewest muscles are in action.

With regard to purging, when we consider the quantity of fluids constantly present in the cavity of the intestines, and the quantity which may be drawn off from the innumerable excretories that open into this cavity, it will be obvious, that a very great evacuation may be made in this way; and if this be done by a stimulus that is not at the same time communicated to the rest of the body, it may, by emptying both the cavity of the intestines and the arteries which furnish the excretions poured into it, induce a considerable relaxation in the whole system; and is therefore suited to moderate the violence of reaction in fevers. But it is to be observed, that as the fluid drawn from the excretories opening into the intestines is not all drawn immediately from the arteries, and as what is even more immediately drawn from these is drawn off slowly; so the evacuation will not, in proportion to its quantity, occasion such a sudden depletion of the red vessels as blood-letting does; and therefore cannot act so powerfully in taking off the phlogistic diathesis of the system.

Synocha.

At the same time the evacuation may induce a considerable degree of debility; and therefore, in those cases in which a dangerous state of debility is likely to occur, purging is to be employed with a great deal of caution; and this caution is more difficult to be observed than in the case of blood-letting: and it is further to be noticed, that as purging takes off in some measure the determination of the blood to the vessels on the surface of the body, it seems to be an evacuation not well adapted to the cure of fevers.

II. The other method of moderating the violence of reaction in fevers is by the exhibition of those remedies suited to take off the spasm of the extreme vessels, supposed to be the irritation which chiefly supports the reaction. The means to be employed for this purpose are either internal or external.

First, The internal means are, 1. Those which determine the force of the circulation to the extreme vessels, on the surface of the body, and, by restoring the tone and activity of these vessels, overcome the spasm on their extremities. 2. Those medicines which have the power of taking off spasm in any part of the system, and which are known under the title of ANTISPASMODICS.

(1.) Those remedies which are fit to determine to the surface of the body are, 1. Diluents. 2. Neutral salts. 3. Sudorifics. 4. Emetics.

1. Water enters, in a large proportion, into the composition of all the animal fluids, and a large quantity of it is always diffused through the whole of the common mass. In a sound state, the fluidity of the whole mass depends upon the quantity of water present in it. Water therefore is the proper diluent of our mass of blood, and other fluids are diluent only in proportion to the quantity of water they contain.

In a healthy state, also, the fulness of the extreme vessels and the quantity of excretion are in proportion to the quantity of water present in the body. But in fever, though the excretions be in some measure interrupted, they continue in such quantity as to exhale the more fluid parts of the blood; and, while a portion of them is at the same time necessarily retained in the larger vessels, the smaller, and the extreme vessels, both from the deficiency of fluid and their own contracted state, are less filled, and therefore allowed to remain in that condition. To remedy this contracted state, nothing is more necessary than a large supply of water or watery fluids taken in by drinking or otherwise; for as any superfluous quantity of water is forced off by the several excretories, such a force applied may be a means of dilating the extreme vessels, and of overcoming the spasm affecting the extremities. Accordingly, the throwing in of a large quantity of watery fluids has been, at all times, a remedy much employed in fevers; and in no instance more remarkably than by the Spanish and Italian physicians, in the use of what they call the *dieta aquea*. This practice consists in taking away every other kind of aliment and drink, and in giving, in divided portions, every

Febres. every day for ſeveral days together, ſix or eight pounds of plain water, generally cold, but ſometimes warm. All this, however, is to be done only after the diſeaſe has continued for ſome time, and at leaſt for a week.

7. A ſecond means of determining to the ſurface of the body, is by the uſe of neutral ſalts. Theſe neutrals, in a certain doſe, taken into the ſtomach, produce ſoon after a ſenſe of heat upon the ſurface of the body; and, if the body be covered cloſe and kept warm, a ſweat is readily brought out. The ſame medicines taken during the cold ſtage of a fever, very often put an end to it, and bring on the hot one; and they are alſo remarkable for ſtopping the vomiting which ſo frequently attends the cold ſtage of fevers. All this ſhows, that neutral ſalts have a power of determining the blood to the ſurface of the body, and may therefore be of uſe in taking off the ſpaſm which ſubſiſts there in fevers. The neutral moſt commonly employed in fevers, is that formed of an alkali with the native acid of vegetables. But all the other neutrals have more or leſs of the ſame virtue; and perhaps ſome of them, particularly the ammoniacal ſalts, poſſeſs it in a ſtronger degree. As cold water taken into the ſtomach often ſhows the ſame diaphoretic effects with the neutral ſalts, it is probable that the effect of the latter depends upon their refrigerant powers.

3. A third method of determining to the ſurface of the body, and taking off the ſpaſm ſubſiſting there, is by the uſe of ſudorifics and of ſweating. The propriety of this remedy has been much diſputed; and many ſpecious arguments may be adduced both for and againſt the practice. In its favour may be urged, 1. That in healthy perſons, in every caſe of increaſed action of the heart and arteries, a ſweating takes place, and is, ſeemingly, the means of preventing the bad effects of ſuch increaſed action. 3. That, in fevers, their moſt uſual ſolution and termination is by ſpontaneous ſweating. 3. That, even when excited by art, is has been found uſeful at certain periods, and in certain ſpecies of fever.—On the other hand, it may be urged againſt the practice of ſweating, 1. That in fevers, as a ſpontaneous ſweating does not immediately come on, there are ſome circumſtances different from thoſe in the ſtate of health, and which may render it doubtful whether the ſweating can be ſafely excited by art. 2. That in many caſes the practice has been attended with bad conſequences. The means commonly employed have a tendency to produce an inflammatory diatheſis; which, if not taken off by the ſweat ſucceeding, muſt be increaſed with much danger. Thus ſweating employed to prevent the acceſſions of intermitting fevers has often changed them into a continued form, which is always dangerous. 3. The utility of the practice is doubtful, as ſweating, when it happens, does not always give a final determination, as muſt be manifeſt in the caſe of intermittents, and in many continued fevers which are ſometimes in the beginning attended with ſweatings which do not prove final; and, on the contrary, whether they be ſpontaneous or excited by art, they ſeem often to aggravate the diſeaſe.

From theſe conſiderations, it is doubtful if the practice of ſweating can be admitted very generally; but, at the ſame time, it is alſo very doubtful if the failure of the practice, or the miſchiefs ſaid to ariſe from it, have not been owing to the improper conduct of the practitioner. With reſpect to the laſt, it is almoſt agreed among phyſicians, 1. That ſweating has been generally hurtful when excited by ſtimulant, heating, and inflammatory medicines. 2. That it has been hurtful when excited by much external heat, and continued with a great increaſe of the heat of the body. 3. That it is always hurtful when it does not relieve; and rather increaſes the frequency and hardneſs of the pulſe, the anxiety and difficulty of breathing, the head-ach, and delirium. 4. That it is always hurtful if it be urged when the ſweat is not fluid, and when it is partial and on the ſuperior parts of the body only.

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In theſe caſes, it is probable, that either an inflammatory diatheſis is produced, which increaſes the ſpaſm on the extreme veſſels; or that, from other cauſes, the ſpaſm is too much fixed to yield eaſily to the increaſed action of the heart and arteries; and upon either ſuppoſition it muſt be obvious, that urging the ſweat may produce determinations to ſome of the internal parts, with very great danger.

Notwithſtanding theſe doubts, however, it ſtill remains true, 1. That ſweating has been often uſeful in preventing the acceſſions of fevers when they have been certainly foreſeen, and a proper conduct employed. 2. That even after fevers have in ſome meaſure come on, ſweating has interrupted their progreſs when properly employed, either at the very beginning of the diſeaſe, or during its approach and gradual formation. 3. That even after pyrexiæ have continued for ſome time, ſweating has been ſucceſsfully employed in curing them, as is particularly exemplified in the caſe of a rheumatiſm. 4. That certain fevers produced by a very powerful ſedative contagion, have been generally treated moſt ſucceſsfully by ſweating.

Theſe inſtances are in favour of ſweating, but give no general rule; and it muſt be left to farther experience to determine how far any general rule can be eſtabliſhed in this matter. In the mean time, if the practice of ſweating is to be attempted, the following rules may be laid down for the conduct of it. 1. That a ſweat ſhould be excited without the uſe of ſtimulant inflammatory medicines. 2. That it ſhould be excited with as little external heat, and with as little increaſe of the heat of the body as poſſible. 3. That, when excited, it ſhould be continued for a due length of time; not leſs than 12 hours, and ſometimes for 24 or 48 hours; always, however, ſuppoſing that it proceeds without the dangerous circumſtances already mentioned. 4. That for ſome part of the time, and as long as the perſon can eaſily bear, it ſhould be carried on without admitting of ſleep. 5. That it ſhould be rendered univerſal over the whole body; and therefore particularly that care ſhould be taken to bring the ſweating to the lower extremities. 6. That the practice ſhould be rendered ſafer by moderate purging excited at the ſame time. 7. That it ſhould not be ſuddenly checked by cold any how applied to the body.

When attention is to be given to theſe rules, the ſweating may be excited, 1. By warm bathing, or a fomentation of the lower extremities. 2. By frequent draughts of tepid liquors, chiefly water, rendered more grateful

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The fourth mean of determining to the surface of the body, and thereby taking off the spasm affecting the extreme vessels, is by the use of emetics. These, particularly of the antimonial kind, have been employed in the cure of fevers ever since the introduction of chemical medicines; and though of late their use has become very general, their efficacy is still disputed, and their manner of operating is differently explained.

Vomiting is in many respects useful in fevers; as it evacuates the contents of the stomach, as it emulges the biliary and pancreatic ducts, and evacuates the contents of the duodenum, and perhaps also of a larger portion of the intestines; as it agitates the whole of the abdominal viscera, it expedes the circulation in them, and promotes their several secretions; and lastly, as it agitates also the viscera of the thorax, it has like effects there.

It is not to this cause, however, that we are to impute the effect vomiting has in determining to the surface of the body. This must be attributed to the particular operation of emetics upon the muscular fibres of the stomach, whereby they excite the action of the extreme arteries on the surface of the body, and by this means effectually determine the blood to these vessels, remove the atony, and take off the spasm affecting them. For this purpose they are exhibited in two different ways; that is, either in such doses as may excite full and repeated vomitings, or in such doses as may excite sickness and nausea only, with little or no vomiting at all.

Full vomiting is well suited to determine to the surface of the body, and therefore to obviate the atony and spasm which lay the foundation of fever. Thus, vomiting excited a little before the expected accession of the paroxysm of an intermittent, has been found to prevent the paroxysm altogether. It has been observed also, that when contagion has been applied to a person, and first discovers its operation, a vomit given has prevented the fever which might otherwise have been expected.

These are the advantages to be obtained by exciting vomiting at the first approach of fevers, or of the paroxysm of fevers; and they may also be applied after fevers are formed, to take off, perhaps entirely, the atony and spasm, or at least to moderate these, so that the fever may proceed more gently and safely. It is seldom, however, that vomiting is found to produce a final solution of fevers; and after they are once formed, it is commonly necessary to repeat the vomiting several times; but this is attended with inconveniency, and sometimes with disadvantage. The operation of full vomiting is transitory, and the exercise of vomiting is a debilitating power; and therefore, when the vomiting does not remove the atony and spasm very entirely, it may give occasion to their recurrence with greater force. For these reasons, after fevers are fully formed, some physicians have thought proper to employ emetics in nauseating doses only. These are capable of exciting the action of the extreme vessels, and their operation is more permanent. At the same time they often show their power by exciting some degree of sweat, and their operation is rendered more safe by their commonly producing some evacuation by stool. But nausea continued for any great length of time, is to most patients a sensation highly distressing, and almost insufferable. Synocha.

The emetics chiefly in use at present are, ipecacuanha and antimony. The former may be employed for determining to the surface of the body: but, even in very small doses, it so readily excites vomiting, that it is with difficulty employed for the purpose of nauseating only; and in whatever manner employed, there is reason to suspect that its effects are less permanent, and less powerfully communicated from the stomach to the rest of the system, than those of antimony. This last is therefore generally preferred; and its preparations, seemingly various, may all be reduced to two heads; one comprehending those in which the reguline part is in a condition to be acted upon by acids, and therefore on meeting with acids in the stomach it becomes active; and another, comprehending those preparations in which the reguline part is already joined with an acid, rendering it active. Of each kind there are great numbers, but not differing essentially from one another; the two most worthy of notice are, the *calx nitrata antimonii* and *emetic tartar* or *antimonium tartarisatum*, of the Edinburgh dispensatory. Both these are very efficacious medicines; but the latter seems preferable, because its dose is capable of being better ascertained; though the former, on account of its slower operation, may have some advantages, and in certain cases be more efficacious as a purgative and sudorific.

The *calx nitrata antimonii*, when first introduced into the pharmacopœia of the Edinburgh college, was supposed to be very nearly, if not precisely, the same with a medicine which has of late been highly celebrated in the cure of fevers, Dr James's powder. But from later and more accurate observations, there is now reason to believe that the pulvis antimonialis of the London pharmacopœia, formed by the calcination of antimony with hartshorn, approaches more nearly to that celebrated arcanum. But at any rate, the calx antimonii nitrata, the pulvis antimonialis, and James's powder, are probably not essentially different from each other. The two latter, however, have the most near resemblance; and accordingly the Edinburgh college in the last edition of their pharmacopœia have introduced an article under the title of *antimonium calcareo-phosphoratum*, which they consider as so much similar to James's powder, that they have used as a synonyme for it, the title of *pulvis Jacobi*.

The time most proper for exhibiting these medicines is a little before the accession, when that can be certainly known. In continued fevers the exacerbations are not always very observable; but there is reason to believe, that one commonly happens about noon or soon after it; and that these, therefore, are the most proper times for exhibiting emetics.

With respect to the manner of administration, that of the *calx nitrata* is simple, as the whole of what is thought a proper dose may be given at once; and no more can be properly given till the next accession. The administration of the emetic tartar is different. It is to be given in small doses, not sufficient to excite vomiting,

Fevers. miting; and these doses are to be repeated after short intervals for several times, till sickness, nausea, and some, though not much, vomiting come on. The difference of administration must depend upon the dose, and the length of the interval at which it is given. If it be intended that the medicine should certainly operate by stool, the doses are made small, and the intervals long. On the contrary, when vomiting is proper, or when much purging ought to be avoided, and therefore some vomiting must be admitted, the doses are made larger, and the intervals shorter. With respect to both kinds of preparations, the repetition is to be made at the times of accession, but not very often: for if the first exhibitions, duly managed, have little effect, it is seldom that the after exhibitions have much; and it sometimes happens that the repeated vomiting, and especially repeated purging, does harm by weakening the patient.

(2.) The other set of internal medicines which are supposed useful in taking off the spasm of the extreme vessels, are those named *antispasmodic*. But whatever may be the virtues of some of them in this way, such is their power of stimulating at the same time, that very few of them can with safety be administered in fevers of an inflammatory nature. Almost the only one which can with safety be exhibited in these cases is camphor; and the operations of this are by no means well ascertained. Dr Huxham mentions it as a corrector of the acrimony of cantharides; and assures us, that it very effectually promotes a diaphoresis. But from the remarks of other practioners, we have no just reason to suppose that it acts perceptibly in a dose of five or six grains, though in 15 or 20 it produces a particular kind of intoxication:

Secondly. The external means suited to take off the spasm of the extreme vessels, are blistering and warm bathing.

1. What are the effects of blistering so frequently employed in fevers, is not yet agreed upon among physicians. Dr Callen is of opinion, that the small quantity of cantharides absorbed from a blistering plaster, is not sufficient to change the consistence of the mass of blood; and therefore, that such a quantity can neither do good by resolving phlogistic lentor if it exists, nor do harm by increasing the dissolution of the blood arising from a putrid tendency in it. The effects of cantharides upon the fluids, therefore may be entirely neglected. The inflammation produced by the application of cantharides to the skin, affords a certain proof of their stimulant power: but in many persons the effect of that stimulus is not considerable; in many it is not communicated to the whole system; and even when it does take place in the whole system, it seems to be taken off very entirely by the effusion and evacuation of serum from the blistered part. It may be concluded, therefore, that neither much good is to be expected nor much harm to be apprehended, from the stimulant power of blistering; and the certainty of this conclusion is established by the great benefit arising from the proper practice of blistering in inflammatory diseases. Much has been imputed to the evacuation made by blistering; but it is never so considerable as to affect the whole system; and therefore can neither by a sudden depletion relax the sanguiferous system, nor by any revulsion affect the general distribution of the fluids. The evacuation, however, is so considerable as to affect the neighbouring vessels; and the manifest utility of blistering near the part affected in inflammatory diseases leads us to think, that blistering, by deriving to the skin, and producing and effusion there, relaxes the spasm of the deeper seated vessels. It is in this manner, most probably, that the tumor of a joint, from an effusion into the cellular texture under the skin, takes off the rheumatic pain formerly affecting that joint. Analogous to this, probably, is the good effect of blistering in continued fevers; and arises from the relaxation of the spasm of the extreme vessels by a communication of the blistered part with the rest of the skin. A blister may be employed at any period in continued fevers; but it will be of most advantage in the advanced state of such fevers, when, the reaction being weaker, all ambiguity from the stimulating power of blistering is removed, and when it may best concur with other circumstances tending to a final solution of the spasm.

From this view of the matter, it will appear, that the part of the body to which blisters ought to be applied is indifferent, except upon the suspicion of topical affection, when the blistering is to be made as near as possible to the part affected. Whether sinapisms and other *rubefacientia* act in a manner analogous to what has been supposed of blistering may be doubtful; but their effects in rheumatism and other inflammatory diseases render it probable.

2. The other external means of taking off the spasm of the extreme vessels is warm bathing. This was frequently, and in different circumstances, employed by the ancients; but has, till very lately, been neglected by modern physicians. As the heat of the bath stimulates the extreme vessels, and, with the concurrence of moisture, also relaxes them, it seems to be a safe stimulus, and well suited to take off the spasm affecting these vessels. It may be applied to the whole body by immersion; but this is in many respects inconvenient; but whether some of the inconveniences of immersion might not be avoided by a vapour-bath, is not yet determined by experience; but from extensive experience it appears, that most of the purposes of warm bathing can be obtained by a fomentation of the legs and feet, if properly administered, and continued for a due length of time, not less than an hour. The marks of the good effect of such a fomentation are, the patient's bearing it easily, its relieving delirium, and inducing sleep.

Typhus.

Genus V. TYPHUS; the *Typhus Fever*.

Typhus, *Sauv.* Gen. 82. *Sag.* 677.

I. Typhus mitior, or the *Slow Nervous Fever*. Sp. I. var. 1.

Febris maligna hectica convulsiva, sive lues νευρωδης, *Willis*, de morb. convulsiva. cap. 8.

Febris pestilens, *Fracastor*. de morb. contag. L. II. cap. 4.

Febris pestilens sine charactere veneni, *Forest*, L. VI. obs. 26.

Febris hectica pestilens, *Forest*, L. VI. obs. 32.

Febris nova ann. 1685, *Sydenham*, Sched. monitor.

Febris putrida nervosa, *Wintringh*. Com. Nosolog. ad ann. 1720, 1721.

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Febris lenta nervosa, *Huxham* on fevers, chap. 8.
Febris contagiosa, *Lind* on fevers and infection, *passim*.
Typhus nervosus, *Sauv.* sp. 2.
Typhus comatosus, *Sauv.* sp. 3.
Tritæophya typhodes Mangeti, *Sauv.* sp. 11. *Raym. Fort.* de febribus.

Description. Of all the descriptions we have of the nervous fever, that of Dr Huxham is perhaps the best. According to him, the patient at first grows somewhat listless, and feels slight chills and shudders, with uncertain flushes of heat, and a kind of weariness all over, like what is felt after great fatigue. This is always attended with a sort of heaviness and dejection of spirit, and more or less of a load, pain, or giddiness of the head; a nausea and disrelish of every thing soon follows, without any considerable thirst, but frequently with urging to vomit, though little but insipid phlegm is brought up. Though a kind of lucid interval of several hours sometimes intervenes, yet the symptoms return with aggravation, especially towards night; the head grows more giddy or heavy; the heat greater: the pulse quicker, but weak; with an oppressive kind of breathing. A great torpor, or obtuse pain and coldness, affects the hinder-part of the head frequently, and oftentimes a heavy pain is felt on the top all along the *coronary future;* this, and that of the back-part of the head, generally attend nervous fevers, and are commonly succeeded by some degree of a delirium. In this condition the patient often continues for five or six days, with a heavy, pale, sunk countenance; seemingly not very sick, and yet far from being well; restless, anxious, and commonly quite void of sleep, though sometimes very drowsy and heavy; but although he appears to those about him actually to sleep, he is utterly insensible of it, and denies that he doth so. The pulse during all this time is quick, weak, and unequal; sometimes fluttering, and sometimes for a few moments slow; nay, even intermitting, and then, with a sudden flush in the face, immediately very quick, and perhaps soon after surprisingly calm and equal; and thus alternately. The heats and chills are as uncertain and unequal; sometimes a sudden colour and glow arise in the cheeks, while the tip of the nose and ear is cold, and the forehead at the same time in a cold dewy sweat. Nay, it is very common, that a high colour and heat appear in the face, when the extremities are quite cold. The urine is commonly pale, and often limpid; frequently of a whey colour, or like vapid small-beer, in which there is either no manner of sediment, or a kind of loose matter like bran irregularly scattered up and down in it. The tongue at the beginning is seldom or never dry or discoloured, but sometimes covered with a thin whitish mucus: at length, indeed, it often appears very dry, red, and chapped, or of the colour of pomegranate-rind; but this mostly at the close of the disease: yet, however dry the tongue and lips seem, the patient scarce ever complains of thirst, though sometimes of a heat in the tongue. About the seventh or eighth day, the giddiness, pain, or heaviness of the head become much greater, with a constant noise in it, or *tinnitus aurium;* which is very disturbing to the sick, and frequently brings on a delirium. The load on the præcordia, anxiety and faintness, grow much more urgent; and they often fall into an actual deliquium, especially if they attempt to sit up; cold sweats suddenly come out on the forehead, and on the backs of the hands (though at the same time there is too much heat in the cheeks and palms), and as suddenly go off. If the urine now grows more pale and limpid, a delirium is certainly to be expected, with universal tremors and *subsultus tendinum;* the delirium is seldom violent, but as it were a confusion of thought and action, muttering continually to themselves, and faltering in their speech. Sometimes they awake only in a hurry and confusion, and presently recollect themselves, but forthwith fall into a muttering dozy state again. The tongue grows often very dry at the height, especially in its middle part, with a yellowish list on each side, and trembles greatly when the sick attempts to put it out. Frequently profuse sweats pour forth all at once, about the ninth, tenth, or twelfth day, commonly coldish and clammy on the extremities; oftentimes very thin stools are discharged, and then nature sinks apace; the extremities grow cold, the nails pale or livid; the pulse may be said to tremble and flutter, rather than to beat, the vibrations being so exceeding weak and quick that they can scarce be distinguished; though sometimes they creep on surprisingly slow, and very frequently intermit. The sick become quite insensible and stupid, scarce affected with the loudest noise or the strongest light; though, at the beginning, strangely susceptible of the impressions of either. The delirium now ends in a profound coma, and that soon in eternal sleep. The stools, urine, and tears, run off involuntarily, and denounce a speedy dissolution, as the vast tremblings and twitchings of the nerves and tendons are preludes to a general convulsion, which at once snaps off the thread of life. In one or other of these ways are the sick carried off, after having languished for 14, 18, or 20 days; nay, sometimes much longer. Most patients grow deaf and stupid towards the end of this disease, (some extremely deaf), though too quick and apprehensive at the beginning; insomuch that the least noise or light greatly offended them. Many from their immoderate fears seem to hurry themselves out of life, where little danger is apparent at the beginning: nay, some will not allow themselves to sleep, from a vain fear of dozing quite away; and others from the vast hurry, anxiety, and confusion they are sensible of either during sleep or at their waking.

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Causes of, and persons subject to, the disorder. The nervous fever is most frequently the consequence of contagion. It most commonly attacks persons of weak nerves, a lax habit of body, and a poor thin blood; those who have suffered great evacutions, a long dejection of spirits, immoderate watchings, studies, fatigue, &c.; also those who have used much crude unwholesome food, vapid impure drinks, or who have been confined long in damp foul air; who have broken the vigour of their constitutions by salivations, too frequent purging, immoderate venery, &c. Hence we see how the disease is connected with an extreme debility of the nervous system; for, when people are prepared for this fever by having their nerves already weakened, the contagious particles immediately attack the nervous system, without

Febres. out so much affecting the state of the blood or juices, though the latter are greatly affected in the putrid malignant fevers.

Prognosis. In nervous fevers, the prognosis is very much the same as that with the putrid malignant kind. And although death be not so frequent as in that modification of fever, yet it may justly be considered as a very fatal disease.

Cure. As this fever is produced by a contagion affecting the nervous system of a person already debilitated, and thus producing weakness in an extreme degree, we have now occasion to consider Dr Cullen's *two indications* of cure omitted under the *Synocha;* namely, to remove the cause and obviate the effects of debility, and to correct the putrescent tendency of the fluids; for though, in the beginning of nervous fevers, the tendency to putrefaction be not remarkable, it becomes exceedingly great towards their conclusion.

[1.] In answering the first indication, Dr Cullen observes, that most of the sedative powers inducing debility cease to act soon after they have been applied; and therefore the removing of them is not an object of the present indication. There is only one which may be supposed to continue to act for a long time, and that is the contagion applied; but we know nothing in the nature of contagion that can lead us to any measures for removing or correcting it. We know only its effects as a sedative power inducing debility, or as a ferment inducing a tendency to putrefaction in the fluids, the former of which at present falls under our consideration.—The debility induced in fevers by contagion, or other causes, appears especially in the weaker energy of the brain; but in what this consists, or how it may be restored, we do not well know; but as nature, seemingly for this purpose, excites the motion of the heart and arteries, we must ascribe the continuance of the debility to the weaker re-action of the sanguiferous system: the means, therefore, which we employ for obviating debility, are immediately directed to support and increase the action of the heart and arteries; and the remedies employed are tonics or stimulants.

In contagious diseases we know, both from the effects which appear, and from dissections, that the tone of the heart and arteries is considerably diminished; and that tonic remedies are therefore properly indicated. We are to consider these remedies as of two kinds; 1. The power of cold; 2. That of tonic medicines.

The power of cold as a tonic in fevers may be employed in two ways: either as thrown into the stomach, or as applied to the surface of the body. As we have already observed that the power of cold may be communicated from any one part to every other part of the system, so it will be readily allowed that the stomach is a part as fit as any other for this communication, and that cold drink taken into the stomach may prove an useful tonic in fevers. This the experience of all ages has confirmed; but at the same time it has been frequently observed, that, in certain circumstances, cold drink taken into the stomach has proved very hurtful; and therefore that its use in fevers requires some limitations. What these limitations should be, and what are all the circumstances which may forbid the use of cold drink, it is difficult to determine; but it seems clearly forbidden in all cases where a phlogistic diathesis prevails in the system, and more especially when there are topical affections of an inflammatory nature. Typhus.

The other method of employing cold as a tonic, is by applying it to the surface of the body, as a refrigerant power fit to moderate the violence of re-action; but probably it may here also be considered properly as a tonic, and useful in cases of debility.—Not only cool air, but cold water also may be applied to the surface of the body as a tonic. The ancients frequently applied it with advantage to particular parts as a tonic; but it is a discovery of modern times, that, in the case of putrid fevers attended with much debility, the body may be washed all over with cold water. This was first practised at Breslaw in Silesia, as appears from a dissertation under the title of *Epidemia Verna, quæ Wratislaviam anno* 1737 *afflixit*, to be found in the *Acta Nat. Curios.* vol. x. And from other writers it appears, that the practice has passed into some of the neighbouring countries; but in Britain it does not appear that they have yet had any experience of it.

The medicines which have been employed in fevers as tonics are various. If the *saccharum saturni* hath been found useful, it is probably as a tonic rather than as a refrigerant; and the *ens veneris*, or other preparations of iron which have been employed, can act as tonics only. The preparations of copper, from their effects in epilepsy, are presumed to possess a tonic power; but whether their use in fevers be founded on their tonic or emetic powers, is uncertain. And upon the whole there may no doubt occur some instances of fevers being cured by tonics taken from the fossile kingdom; but the vegetable tonics are the most efficacious, and among these the Peruvian bark certainly holds the first place.

The bark has commonly been considered as a specific, or a remedy of which the operation was not understood. We must observe, however, that, as in many cases the effects of the bark are perceived soon after its being taken into the stomach, and before it can possibly be conveyed to the mass of blood, we may conclude, that its effects do not arise from its operating on the fluids; and must therefore depend upon its operating on the nerves of the stomach, and being thereby communicated to the rest of the nervous system. This operation seems to be a tonic power, the bark being a remedy in many cases of debility, particularly in gangrene: and if its operation may be explained from its possessing a tonic power, we may easily perceive why it is improper when a phlogistic diathesis prevails; and from the same view we can ascertain in what cases of continued fever it may be admitted. These cases are either where considerable remissions have appeared, when it may be employed to prevent the return of exacerbations, on the same footing as it is used in intermitting fevers; or in the advanced state of fevers, when all suspicion of an inflammatory state is removed, and a general debility prevails in the system; and its being then employed is sufficiently agreeable to the present practice.

Another set of medicines to be employed for obviating debility and its effects, are the direct stimulants.

Febres. lants. These, in some measure, increase the tone of the moving fibres; but are different from the tonics, as they more directly excite and increase the action of the heart and arteries. This mode of their operation renders their use ambiguous; and when an inflammatory diathesis is present, the effects of the stimulants may be very hurtful; but it is still probable, that in the advanced state of these fevers, when debility prevails, they may be useful.

Of all the stimulants which may be properly employed, wine seems to be the most eligible. It has the advantage of being grateful to the palate and stomach, and of having its stimulant parts so much diluted, that it can be conveniently given in small doses; and therefore it may be employed with sufficient caution; but it is of little service unless taken pretty largely.—It may be suspected that wine has an operation analogous to that of opium; and on good grounds. But we can distinctly remark its stimulant power only; which renders its effects in the phrenitic delirium manifestly hurtful; and in the mild delirium depending on debility, as remarkably useful.

[2.] We must now proceed to the other indication of cure, namely to correct or obviate the tendency in the fluids to putrefaction. This may be done, 1. By avoiding any new application of putrid or putrescent matter. 2. By evacuating the putrid or putrescent matter already present in the body. 3. By correcting the putrid or putrescent matter remaining in the body by diluents and antiseptics. 4. By supporting the tone of the vessels, and thereby resisting further putrefaction, or obviating its effects. 5. By moderating the violence of re-action, considered as a means of increasing putrefaction.

The further application of putrid or putrescent matter may be avoided, 1. By removing the patient from places filled with corrupted air. 2. By preventing the accumulation of the patients own effluvia, by a constant ventilation, and by a frequent change of bed-clothes and body-linen. 3. By the careful and speedy removal of all excremental matters from the patient's chamber. 4. By avoiding animal-food.

The putrid or putrescent matter already present in the body, may be evacuated partly by frequent evacuations of the contents of the intestines; and more effectually still by supporting the excretions of perspiration and urine by the plentiful use of diluents. That which remains in the body may be rendered more mild and innocent by the use of diluents, or may be corrected by the use of antiseptics. These last are of many and various kinds; but which of them are conveniently applicable, or more particularly suited to the case of fevers, is not well ascertained. Those most certainly applicable and useful are acescent aliments, acids of all kinds, and neutral salts.

The progress of putrefaction may be considerably retarded, and its effects obviated, by supporting the tone of the vessels; and this may be done by tonic medicines, of which the chief are cold, and the Peruvian bark, as already mentioned. The violence of re-action increasing the tendency to putrefaction, may be moderated by the means already mentioned under *synocha*.

These are the proper indications to be observed in the cure of the slow nervous fever. Dr Huxham observes, that evacuations (especially bleeding) are improper even at the beginning. Even a common purgative given at this time hath been followed by surprising languors, syncope, and a train of other ill symptoms. However, it may sometime be necessary to cleanse the stomach and primæ viæ by a gentle emetic, or a mild laxative. Indeed where nausea, sickness, and load at stomach are urgent, as is frequently the case in the beginning of this fever, a vomit is necessary. Clysters of milk, sugar, and salt, may be injected with safety and advantage every second or third day, if nature wants to be prompted to stool. The temperate, cordial, diaphoretic medicines, are certainly, according to our author, most proper in these fevers; and a well-regulated, supporting, diluting diet, is necessary. The latter of itself, judiciously managed, will go a great way in the cure, especially assisted by well-timed and well-applied blisters, and a due care to keep the patient as quiet as possible both in body and mind. But it should be noted, that any strong opiates are commonly very pernicious, however, much the want of sleep and restlessness may seem to demand them. Mild diaphoretics, such as neutral draughts or elixir paregoricum, have much better effects; which, by raising a gentle easy sweat, or at least a plentiful perspiration, calm the hurry of the spirits, and a refreshing sleep ensues. Where the confusion and dejection of spirits are very considerable, blisters have been advised to be applied to the neck, occiput, or behind the ears; and during all this a free use of thin wine-whey, some pleasant ptisan or gruel, with a little soft wine, must be indulged. Indeed the patients, in this case, should drink frequently; though such quantities may not be necessary as in the ardent, or even putrid malignant fevers; yet they should be sufficient to carry on the work of dilution, support the sweats, and supply the blood with fresh and wholesome fluids, in place of that noxious matter which is continually passing off. In this view also a thin chicken-broth is of service, both as food and physic, especially towards the decline of the disease; and for the same reason thin jellies of hartshorn, sago, panada, are useful, adding a little wine to them, and the juice of Seville orange or lemon.

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It is observable, that the sick are never so easy as when they are in a gentle sweat; for this soon removes the hurry of spirits, exacerbations of heat, &c. But profuse sweats should never be encouraged, much less attempted, by very strong heating medicines, especially in the beginning or advance of the fever; for they too much exhaust the vital power, and are followed by a vast dejection of spirits, tremors, startings of the tendons, and sometimes end in rigors, cold clammy sweats, syncope, or a comatose disposition. Sometimes irregular partial heats and flushes succeed, with great anxiety, restlessness, delirium, difficulty of breathing, and a vast load and oppression in the præcordia, so as to incline the less cautious observer to think there may be something peripneumonic in it; but even here we must beware of bleeding, as the pulse will be found very small and unequal, though very quick. Nor is bleeding contra-indicated only by the weakness and fluttering

Febres. flattering of the pulse, but also by the pale, limpid, and watery urine which is commonly attendant. These symptoms denote the load, anxiety, and oppression on the præcordia to proceed from an affection of the nervous system, and not from a peripneumonic obstruction or inflammation. The breathing in this case, though thick and laborious, is not hot, but a kind of sighing or sobbing respiration, nor is there often any kind of cough concomitant; so that it has been conjectured to proceed from some spasm on the vitals. Here therefore the nervous cordial medicines are indicated, and blisters to the thighs, legs, or arms. Dr Huxham commonly used the following bolus and saline draught.

R. Pulv. contrayerv. comp. gr. xv.
Croc. Angl. gr. iij.
Confect. Ralegh. ℈j.
Syr. Croci. q. s. M. *f. Bolus.*

R. Sal. C. C. ℈ss.
Succ. limon. ʒiij.
Aq. alexit. simpl. ℥iss. M. *Peracta effervescentia, adde Sp. lavend. c. Syr. croc.* ana ʒiiss. *M. f. Haust.*

If great tremors and subsultus tendinum came on, he substituted half a scruple of musk instead of the contrayerva in the bolus, with advantage. One or other of these, or similar prescriptions, are to be taken every fifth, sixth, or eighth hour, and a temperate cordial julep may be now and then given out of thin wine or cyder whey, or, which is in many cases better, out of mustard-whey; which last is by no means a contemptible medicine. The saline draught made as above, is much more apt to pass through the pores of the skin than when made with salt of wormwood, which rather moves through the urinary passages.

The abovementioned difficulty of breathing, anxiety, and oppression, many times precede a miliary eruption, which often appears on the seventh, ninth, or eleventh day of the fever, and sometimes later. Indeed great anxiety and oppression on the præcordia always precede pustular eruptions of any kind in all sorts of fevers. This eruption should be promoted by soft easy cordials and proper diluents; to which should be sometimes added some gentle aromatics. These tend to calm the universal uneasiness commonly complained of, and also very effectually promote a diaphoresis, or breathing kindly sweats, with which the miliary eruptions freely and easily advance. But however advantageous these commonly are, profuse sweats are seldom or never so, even though attended with a very large eruption. Two or three crops of these miliary pustules have been known to succeed one another, following profuse sweats, not only without advantage, but with great detriment to the patients, as they were thereby reduced to an extreme degree of weakness; so that they may justly be reckoned symptomatical rather than any thing else, and the consequent eruption is often merely the symptom of a symptom; for the miliary glands of the skin appear very turgid, and mimic a rash, after profuse sweating, even in the most healthy.

In these profuse colliquative sweatings a little generous red wine (diluted somewhat, if necessary) may be given with the greatest advantage; as it presently moderates the sweats, supports the patient, and keeps up the miliary papulæ if they happen to attend. Towards the decline of the fever also, where the sweats are abundant and weakening, small doses of the tincture of the bark with saffron and snake root were given with the greatest advantage, frequently interposing a dose of rhubarb to carry off the putrid colluvies in the first passages; which withal makes the remission or intermissions that often happen in the decline of nervous diseases more distinct and manifest, and gives a fairer opportunity of throwing in the bark; for in the proper exhibition of this medicine we are to place our chief hope of curing both the nervous and putrid malignant fevers. Typhus.

II. Typhus gravior, or the *putrid, pestilential*, or *malignant* FEVER. Sp. I. var. 2.

Febris pestilens, *P. Sal. Divers.* de febre pestilenti.
Febris pestilens Ægyptiorum, *Alpin.* de. med. Ægypt. l. i. cap. 14.
Typhus Ægyptiacus, *Sauv.* sp. 6.
Febris pestilens maligna, *Sennert.* de febribus, l. iv. cap. 10.
Febris maligna pestilens, *River*, l. xvii. sect. iii. cap. 1.
Febris pestilens maligna, ann. 1643. *Willis*, de febribus, cap. 14.
Typhus carcerum, *Sauv.* sp. 1.
Febris nautica pestilentialis, *Huxham* de aëre ad ann. 1740.
Miliaris nautica, *Sauv.* sp. g.
Febris putrida contagiosa in carceribus genita, *Huxham* de aëre ad ann. 1742.
Miliaris purpurata, *Sauv.* sp. h.
Febris carcerum et nosocomiorum. *Pringle*, Diseases of the army, p. 294. *Van Swieten*, Maladies des armés, p. 136.
Typhus castrensis, *Sauv.* sp. 5.
Febris castrensis, quam vulgo cephalalgiam epidemicam vocant, *Henr. Maii* et *A. Ph. Koph.* Diss. apud *Hallerum*, tom. v.
Febris Hungarica sive castrensis, *Juncker*, 74. et *plurium auctorum.*
Febris castrensis Gallorum in Bohemia, ann. 1742. *Scrinci.* Diss. apud *Haller.* tom. v.
Febris petechialis, *Sennert.* l. iv. cap. 13. *River.* prax. l. xvii. sect. iii. cap. 1. *Hoffm.* II. p. 84. *Juncker.* 73. *Huxham* on fevers, chap. 8. *Ludwig.* Inst. med. clin. n° 146. *Schreiber* von erkentness, und cur der Krank heiten. p. 126. *Monro*, Diseases of military hospitals, p. 1.
Febris catarrhalis maligna petechizans, *Juncker*, 72. *Hoffm.* II. 75. *Eller.* de cogn. et cur. morb. sect. vi.
Febris quæ lenticulas, puncticula, aut peticulas vocant, *Fracastorius* de morb. contag. lib. ii. cap. 6.
Febris peticularis Tridenti, ann. 1591. *Roboretus* de febr. peticul.
Febris petechialis epidemica Coloniæ ann. 1672. *Donckers* Idia febris petechialis.
Febris petechialis epidemica Posonii, 1683, *C. F. Loeu* in App. ad A. N. C. vol. ii.
Febris petechialis epidemica Mutinæ, 1692. *Ramazzini.* Const. Mutinensis, oper. p. 177.

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Febris maligna petechizans, ann. 1698. *Hoffm.* II. p. 80.

Febris petechialis Wratiſlaviæ ann. 1699. *Helwich*, Ephem. Germ. D. III. A. VII. et VIII. obſ. 132. p. 616.

Febris epidemia Lipſiæ 1718. *M. Adolph.* A. N. C. III. obſ. 131. p. 296.

Febris endemica et epidemica Corcagienſis ann. 1708, 1718, et ſeq. *Rogers*, eſſay on epidemic diſeaſes.

Febris continua epidemica Corcagienſis ann. 1719, et ſeq. *M. O'Connel* Obſ. de morbis.

Febris petechialis epidemica Cremonæ 1734. *Valcharengki* Med. ration. ſect. 3.

Febris petechizans Petropoli 1735. *Weitbrecht.* Diſſ. apud Haller. tom. v.

Febris petechialis, ann. 1740, 1741, in Haſſia, *Ritter.* A. N. C. vol. vii. obſ. 4.

Febris maligna petechialis Rintelli 1741. *Furſtenau.* A. N. C. vol. vii. obſ. 5.

Febris petechialis epidemica Sileſiæ 1741 et ſeq. *Bandhorſt.* Diſſ. apud *Haller.* tom. v.

Febris petechialis epidemica Viennæ 1757. *Haſenohrl.* Hiſt. med. cap. 2.

Febris petechialis epidemica Lipſiæ 1757. *Luduvig.* Adverſar. tom. i. pars 1.

Febris petechialis epidemica variis Germaniæ locis ab. ann. 1755 ad 1761. *Strack* de morbo cum petechiis.

Deſcription. This diſeaſe has been ſuppoſed to differ from the former in degree only; and there are many circumſtances which would lead us to conclude, that both frequently originate from a contagion preciſely of the ſame nature. In the ſame manner we ſee, during different ſeaſons, and in different circumſtances, various degrees of malignity in ſmall-pox. Though every inſtance of the diſeaſe depends on the introduction of a peculiar and ſpecific contagion into the body, yet this contagion in particular epidemics evidently poſſeſſes peculiar malignancy. The ſame is probably the caſe with the typhoid fever: But whether this obſervation be well founded or not, there cannot be a doubt that the typhus gravior or putrid fever is a diſeaſe of the moſt dangerous nature, as, beſides the extreme debility of the nervous ſyſtem, there is a rapid tedency of the fluids to putrefaction, which ſometimes cuts off the patient in a few days, nay, in the warm climates, in 12 or 14 hours; or if the patient recovers, he is for a long time, even in this country, in an exceedingly weak ſtate, and requires many weeks to recover his former health.

The putrid fevers, according to Huxham, make their attack with much more violence than the ſlow nervous ones; the rigors are ſometimes very great, though ſometimes ſcarce felt; the heats much ſharper and permanent; yet, at firſt, ſudden, tranſient, and remittent; the pulſe more tenſe and hard, but commonly quick and ſmall; though ſometimes ſlow, and ſeemingly regular for a time, and then fluttering and unequal. The head-ach, nauſea, and vomiting, are much more conſiderable even from the beginning. Sometimes a ſevere fixed pain is felt in one or both temples, or over one or both eye-brows; frequently in the bottom of the orbits of the eyes. The eyes always appear very dull, heavy, yellowiſh, and very often a little inflamed. The countenance ſeems bloated, and more dead-coloured than uſual. Commonly the temporal arteries throb much, and tinnitus aurium is very troubleſome; a ſtrong vibration alſo of the carotid arteries frequently takes place in the advance of the fever, though the pulſe at the wriſt may be ſmall, nay even ſlow: this is a certain ſign of an impending delirium, and generally proceeds from ſome conſiderable obſtructions in the brain. Typhus.

The proſtration of ſpirits, weakneſs, and faintneſs, are often ſurpriſingly great and ſudden, though no inordinate evacuation happens; and this too ſometimes when the pulſe ſeems tolerably ſtrong. The reſpiration is moſt commonly laborious and interrupted with a kind of ſighing or ſobbing, and the breath is hot and offenſive.

Few or none of theſe fevers are without a ſort of lumbago, or pain in the back and loins; always an univerſal wearineſs or ſoreneſs is felt, and often much pain in the limbs. Sometimes a great heat, load, and pain, affect the pit of the ſtomach, with perpetual vomiting of porraceous or black choler, and a moſt troubleſome ſingultus; the matter diſcharged is frequently of a very nauſeous ſmell. The tongue, though only white at the beginning, grows daily more dark and dry; ſometimes of a ſhining livid colour, with a kind of dark bubble at top; ſometimes exceeding black; and ſo continues for many days together; nor is the tinct to be got off many times for ſeveral days, even after a favourable criſis: at the height of the diſeaſe, it generally becomes very dry, ſtiff, and black, or of a dark pomegranate colour. Hence the ſpeech is very inarticulate, and ſcarce intelligible. The thirſt in the increaſe of the fever is commonly very great, ſometimes unquenchable; and yet no kind of drink pleaſes, but all ſeem bitter and mawkiſh; at other times, however, no thirſt is complained of, tho' the mouth and tongue are exceedingly foul and dry; this is always a dangerous ſymptom, and ends in a frenzy or coma. The lips and teeth, eſpecially near the height, are furred up with a very black tenacious ſordes. At the onſet of the fever, the urine is often crude, pale, and vapid, but grows much higher-coloured in the advance, and frequently reſembles a ſtrong lixivium, or citrine urine, tinged with a ſmall quantity of blood; it is without the leaſt ſediment or cloud, and ſo continues for many days together; by degrees it grows darker, like dead ſtrong high-coloured beer, and ſmells very rank and offenſive. In petechial fevers, the urine hath often been ſeen almoſt black and very *fetid.* The ſtools, eſpecially near the height, or in the decline of the fever, are for the moſt part intolerably fetid, green, livid, or black, frequently with ſevere gripes and blood. When they are more yellow or brown, the leſs the danger; but the higheſt when they run off inſenſibly, whatever their colour may be. It is likewiſe a very bad ſymptom when the belly continues tenſe, ſwollen, and hard, after profuſe ſtools; for this is generally the conſequence of an inflammation or mortification of the inteſtines. A gentle diarrhœa is often very beneficial, and ſometimes ſeems to be the only way which nature takes to carry off the morbific matter.

Some-

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Sometimes black, livid, dun, or greenish spots appear, which always indicate a high degree of malignity; however, the more florid the spots are, the less danger is to be feared. It is also a good sign when the black or violet petechiæ become of a brighter colour. The large, black, or livid spots, are almost always attended with profuse hæmorrhagies; and the small, dusky, brown spots, like freckles, are not much less dangerous than the livid or black; though they are seldom accompanied with fluxes of blood: excessively profuse, cold, clammy sweats are often concomitant, by which also they sometimes vanish, though without any advantage to the patient. The eruption of the petechiæ is uncertain; sometimes they appear on the fourth or fifth day, though sometimes not till the eleventh, or even later. The *vibices*, or large dark, blue, or greenish marks, seldom appear till very near the fatal period. Frequently also we meet with an efflorescence like the measles in malignant fevers, but of a much more dull and livid hue; in which the skin, especially on the breast, appears as it were marbled or variegated. This in general is an ill symptom, and is often attended with fatal consequences.

Sometimes about the 11th or 14th day, on the occurrence of profuse sweats, the petechiæ disappear, and vast quantities of white miliary pustules break out. This is seldom found of any considerable advantage; but an itching, smarting, red rash, commonly gives great relief; and so do the large, fretting, watery bladders, which many times rise upon the back, breast, shoulders, &c. A scabby eruption likewise about the lips and nose is certainly one of the salutary symptoms; and the more hot and angry it is, so much the better. But of much more uncertain and dangerous event are the brown-coloured aphthæ; nor are those that are exceeding white and thick, like lard, of a very promising aspect. They are soon succeeded by great difficulty of swallowing, pain and ulceration of the fauces, œsophagus, &c. and with an incessant singultus: the whole *primæ viæ* become at last affected; a bloody dysentery comes on, followed by a sphacelation of the intestines; as is evident from the black, sanious, and bloody stools, extremely fetid and infectious. Vibices, or large, black, and bluish marks resembling bruises, are frequently seen towards the close of the fever; and, when attended with lividity and coldness of the extremities, are certain tokens of approaching death. In some cases, the blackness hath been known to reach almost to the elbows, and the hands have been dead-cold for a day or two before the death of the patient.

Such are the general appearances of the putrid malignant fever in this country, among those who enjoy a free air, and are not crowded together, or exposed to the causes of infection: but in jails, hospitals, or other places where the sick are crowded, and in some measure deprived of the benefit of the free air, the symptoms are, if possible, more terrible. Sir John Pringle, who had many opportunities of observing it, tells us, that the jail or hospital fever, in the beginning, is not easy to be distinguished from a common fever. The first symptoms are slight interchanges of heat and cold, a trembling of the hands, sometimes a sense of numbness in the arms, weakness of the limbs, loss of appetite; and the disorder increasing towards night, the body grows hot, the sleep is interrupted, and not refreshing. With these symptoms, for the most part, there is some pain or confusion in the head; the pulse at first is a little quicker than natural, and the patients find themselves too much indisposed to go about business, though too well to be wholly confined. When the fever advances, the abovementioned symptoms are in a higher degree; and in particular the patient complains of a lassitude, nausea, pains in his back, a more constant pain and confusion in his head, attended with an uncommon dejection of spirits. At this time the pulse is never sunk, but beats quick, and often varies in the same day both as to strength and fulness. It is little affected by bleeding once, if a moderate quantity of blood be taken away; but if the evacuation be large, and especially if it be repeated, to answer a false indication of inflammation, the pulse, increasing in frequency, is apt to sink in force, and often irrecoverably, whilst the patient becomes delirious. But withal we must observe, that, in every case, independent of evacuations, the pulse sooner or later sinks, and then gives certain intelligence of the nature of the disease. The appearance of the blood is various; for though it be commonly little altered, yet sometimes it will be sizy, not only on the first attack, but after the fever is formed. The worst appearance is when the crassamentum is dissolved; though this does not happen till the advanced state of the fever: though indeed this seems not easy to be ascertained, as blood has been so seldom taken away at that time. The urine is also various. Sometimes it is of a reddish or flame colour, which it preserves a long time; but it is oftener pale, and changes from time to time in colour as well as crudity, being sometimes clear, sometimes clouded: towards the end, upon a favourable crisis, it becomes thick, but does not always deposit a sediment. If the sick lie warm, and have had no preceding flux, the belly is generally bound; but when they lie cold, as they often do in field-hospitals, the pores of the skin being shut, a diarrhœa is a common symptom, but is not critical. In the worst cases, a flux appears in the last stage; then the stools are involuntary, colliquative, ichorous, or bloody, and have a cadaverous smell; the effects of a mortification of the bowels, and the signs of approaching death. When the hospitals are filled with dysenteric patients, some of the nurses will be infected with the flux only, and others with this fever, ending in these bloody and gangrenous stools.

Typhus.

In the beginning the heat is moderate; and even in the advanced state, on first touching the skin, it seems inconsiderable; but upon feeling the pulse for some time, we are sensible of an uncommon ardour (the *calor mordicans*, as it has been called), leaving an unpleasant sensation on the fingers for a few minutes after. A day or two before death, if care be not taken, the extremities become cold, and the pulse is then hardly to be felt. The skin is generally dry and parched; though sometimes there are longer or shorter sweats, especially in the beginning. Such as are produced by medicine are of no use, except on the first attack, at which time they will often remove the fever; and natural sweats are never critical till the distemper begins to decline. These last are rarely profuse,

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The tongue is commonly dry; and, without constant care of the nurse, becomes hard and brown, with deep chops: But this symptom is common to most fevers. At other times, though rarely, the tongue is soft and moist to the last, but with a mixture of a greenish or yellowish colour. The thirst is sometimes great, but more frequently moderate. In the advanced state, the breath is offensive, and a blackish furring gathers about the roots of the teeth.

Some are never delirious, but all lie under a stupor or confusion; few retain their senses till death: many lose them early, and from two causes; either from immoderate bleeding, or the premature use of warm and spirituous medicines. They rarely sleep; and, unless delirious, have more of a dejected and thoughtful look than what is commonly seen in other fevers. The face is late in acquiring either a ghastly or a very morbid appearance; yet the eyes are always muddy, and generally the white is of a reddish cast as if inflamed. The confusion of the head generally rises to a delirium, especially at night; but, unless by an unseasonable hot regimen, it seldom turns to rage, or to those high flights of imagination common in other fevers. When the delirium comes to that height, the face is flushed, the eyes red, the voice is quick, and the patient struggles to get up. But when that symptom is owing to large evacuations, or only to the advanced state of the disease, the face appears meagre; the eye-lids in slumbers are only half shut; and the voice, which is commonly low and slow, sinks to a degree scarce to be heard. From the beginning, there is generally a great dejection and failure of strength. A tremor of the hands is more common than a starting of the tendons; or if the subsultus occurs, it is in a lesser degree than in many other fevers. In every stage of the disease, as the pulse sinks, the delirium and tremor increase; and in proportion as the pulse rises, the head and spirits are relieved. Sometimes in the beginning, but for the most part in the advanced state, the patient grows dull of hearing, and at last almost deaf. When the fever is protracted, with a slow and low voice, the sick have a particular craving for something cordial, and nothing is so cordial or so acceptable as wine. They long for no food, yet willingly take a little panada if wine be added. But such as are delirious, with a quick voice, wild looks, a subsultus tendinum, or violent actions, though their pulse be sunk, yet bear neither hot medicines, wine, nor the common cordials.

Vomiting, and complaints of a load and sickness at stomach, though usual symptoms, are not essential to the disease; nor are pleuritic stitches, difficulty in breathing, or flying pains, to be referred so much to it as to the constitution of the patient, or to a preceding cold.

A petechial efflorescence is a frequent, though not an inseparable, attendant of this fever. It sometimes appears of a brighter or paler red, at other times of a livid colour, but never rises above the skin. The spots are small; but generally so confluent, that at a little distance the skin appears only somewhat redder than ordinary, as if the colour was uniform; but upon a nearer inspection there are interstices seen. For the most part this eruption is so little conspicuous, that unless it be looked for attentively, it may escape notice. The spots appear thickest on the back and breast, less on the legs and arms, and Sir John Pringle never remembers to have seen any on the face. As to the time of their appearance, he agrees entirely with Dr Huxham. These spots are never critical, nor are they reckoned among the mortal symptoms; but only concur with other signs to ascertain the nature of the disease. The nearer they approach to purple, the more they are to be dreaded. In a few cases, instead of spots, purple streaks and blotches were observed. Sometimes the petechiæ did not appear till after death; and there was one case in which, after bleeding, the petechiæ were seen only on the arm below the ligature, and no where else on the skin. Tyhpus.

The hospital fever, though accounted one of the continued kind, yet has generally some exacerbation at night, with a remission and often partial sweats in the day; and after a long continuance it is apt to change into a hectic, or an intermitting form. The length of the disease is uncertain. Sometimes it terminated either in death or recovery, in seven days after the patient took to his bed; but in the hospitals it generally continued from 14 to 20, and some died or recovered after four weeks. From the time of the sinking of the pulse until death or a favourable crisis, there is perhaps less change to be seen from day to day in this than in most other fevers. When its course is long, it sometimes terminates in suppurations of the parotid or axillary glands; and when these do not appear, it is probable that the fever is kept up by the formation of some internal abscess. The parotid glands themselves do not suppurate, but only some of the lymphatic glands that lie over them. Sir John Pringle observed one instance of a swelling of this kind on both sides, without any previous indisposition, when the person, not suspecting the cause, and applying discutient cataplasms, was, upon the tumor subsiding, seized with the hospital-fever. Many patients after the crisis of this fever complain of a pain in the limbs and want of rest; and almost all of them mention great weakness, confusion in their head, vertigo, and a noise in their ears.

Ten of the bodies of those who died of this distemper in Houghton's regiment were opened. In some, all the cavities were examined; in others, only the brain or the bowels. In some of them, the brain appeared to be suppurated. The first of this kind Sir John Pringle met with at Ghent; but the man being brought into the hospital from the barracks no earlier than two days before he died, he could only conjecture from the symptoms and the imperfect accounts he had of him, that his death was owing to a fever of this kind, after lingering near a month in it. About three ounces of purulent matter was found in the ventricles of the brain, and the whole cortical and medullary substance was uncommonly flaccid and tender; nay, some of the same kind of matter was found in the substance of the upper part of the cerebellum: yet this person, with some stupor and deafness, had his senses till the night before he died; so far, at least, that he answered distinctly when roused and spoken to; but about that time

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Theſe ſuppurations, however, were not conſtant; for another who died about the ſame time and had been ill about the ſame number of days with the like ſymptoms, the pale water excepted, had no abſceſs either in the brain or cerebellum. And two were opened afterwards, in which the cortical ſubſtance of the brain had an inflammatory appearance, but no ſuppuration. In one of them the large inteſtines were corrupted: that man went off with a looſeneſs; and juſt before he died, an ichorous matter was diſcharged from his noſe. In the military hoſpital at Ipſwich, one who unexpectedly died of this fever after having been ſeemingly in a fair way of recovery, had no ſuppuration in his brain; but in another, who died after an abſceſs in both orbits, the brain was found flaccid, and about two ounces of a thin ſerum in the ventricles.

Cauſes of, and perſons ſubject to, this diſorder. The cauſe of this fever, as well as that of the ſlow nervous fever, is an infection or contagion from ſome diſeaſed animal-body, or from corrupted vegetables; and therefore is very little, if at all, different from thoſe peſtilential diſorders which have ariſen after battles, when great numbers of dead bodies were allowed to lie above ground, and infect the air with their effluvia. This is confirmed by an obſervation of Foreſtus, who was eye-witneſs to a diſtemper of this kind (which indeed he calls a *plague*) owing to the ſame cauſe, attended with buboes and a high degree of contagion. The ſame author alſo gives an account of a malignant fever breaking out at Egmont in North-Holland, occaſioned by the rotting of a whale which had been left on the ſhore. We have a like obſervation of a fever affecting the crew of a French ſhip, by the putrefaction of ſome cattle which they had killed on the iſland of Nevis in the Weſt Indies. Theſe men were ſeized with a pain in their head and loins, great weakneſs, and a diſorder of the ſtomach, accompanied with fever. Some had carbuncles; and on others purple ſpots appeared after death.

Galen aſſigns two cauſes for peſtilential fevers: 1. The great heat of the weather, when the humours happen to be in a more putreſcent ſtate than uſual. 2. A putrid ſtate of the air, ariſing either from a multitude of dead bodies left unburied, as after a battle, or from the evaporation of corrupted lakes and marſhes. Typhus.

One of the moſt remarkable diſeaſes incident to an army is related by Diodorus, as breaking out among the Carthaginians at the ſiege of Syracuſe. That author not only relates ſome of its moſt diſtinguiſhing ſymptoms, but reaſons well about its cauſe. He obſerves, that pains in the back and eruptions (φλυκταινοι) were common; that ſome had bloody ſtools; that others were ſeized with a delirium, ſo as to run about and beat all that came in their way; that the phyſicians knew no cure; and that it was the more fatal as the ſick were abandoned by every body on account of the contagion. As to the cauſe, the author takes notice of the multitude of people confined within a narrow compaſs; of the ſituation of the camp in a low and wet ground; of the ſcorching heats in the middle of the day, ſucceeded by the cold and damp air from the marſhes in the night-time; to theſe he adds, the putrid ſteams ariſing firſt from the marſhes, and afterwards from the bodies of thoſe who lay unburied.—This diſtemper ſeems to have been a compound of the marſh and peſtilential fever.

Foreſtus remarks, that, from the putrefaction of the water only, the city of Delft, where he practiſed, was ſcarce ten years together free from the plague or ſome peſtilential diſorder. He adds, that the magiſtrates, upon his repreſentation of the cauſe, erected a wind-mill for moving and refreſhing the water. At that time Holland was much more ſubject to inundations and the ſtagnation of water than at preſent. In 1694, a fever broke out at Rochfort in France, which, on account of the uncommon ſymptoms and great mortality, was at firſt believed to be the plague. But M. Chirac, who was ſent by the court to inquire into its nature, found the cauſe to ariſe from ſome marſhes that had been made by an inundation of the ſea; and obſerved, that the corrupted ſteams, which ſmelled like gun-powder, were carried to the town by the wind, which had long blown from that quarter. About two-thirds of thoſe who were taken ill died. In ſuch as were opened, the brain was found either inflamed or loaded with blood; the fibres of the body were uncommonly tender; and the bowels had either ſuppurated or were mortified.

It is needleſs to mention more inſtances of peſtilential fevers being brought on by the ſteams of corrupted ſubſtances, whether animal or vegetable. In general it may be remarked, that the putrefaction of theſe ſubſtances in a dry air is more apt to bring on a fever of the continued form; but in a moiſt air hath a greater tendency to produce remitting fevers. But it muſt alſo be obſerved, that, even in caſes where the moſt malignant fevers prevail, all perſons are not equally diſpoſed to receive the infection, though equally expoſed to it with others. Some, through mere vigour of body and mind, cannot be infected with the moſt contagious diſeaſes; while, on the other hand, thoſe whoſe bodies are debilitated by a former diſeaſe, by ſtudy, low diet, or want, or thoſe who have laboured under any of the depreſſing paſſions of the mind for ſome time, ſeldom or never eſcape. Men, therefore, who have been weakened by accidents (as thoſe who have undergone a mercurial ſalivation) are very apt to fall into this diſtemper. Thoſe who are taken into crowded hoſpitals, ill of the ſmall-pox,

Febres. however good the ſort may be, fall readily into this fever, and run a greater riſk of dying of it than others. The ſecond fever is attended with double danger, ſeeing the patient has been ſo much weakened by the firſt. A ſure ſign of the corruption of the air in an hoſpital is when many of the nurſes fall ſick.

Prognoſis In theſe fevers we cannot draw a prognoſtic from any ſymptom by itſelf; and perhaps all of them together are more fallible than in others. Generally the following are good: to have little delirium: the ſtrength little impaired; turbid urine in the decline of the diſeaſe; and at that time a gentle ſweat or moiſture diffuſed over the body, or even the ſkin ſoft and the tongue moiſt; or to have ſome looſe ſtools ſucceeded by a diaphoreſis; the pulſe to riſe by wine or cordials, with an abatement of the ſtupor, tremor, and other affections of the brain. Deafneſs is rather a good ſign. A ſediment in the urine, without other changes to the better, is no ſure ſign of recovery; and ſome have recovered in whoſe water there was no ſediment.—The bad ſigns are, a ſubſultus tendinum; the eyes much inflamed and ſtaring; the ſpeech quick, and the ſound of the voice altered; a high delirium; perpetual watchfulneſs; conſtant ſickneſs at the ſtomach, and vomitings; frequent ſtools, with a ſinking pulſe, and the diſorder of the head increaſed; coldneſs of the extremities, and a tremulous motion of the tongue. It is obſerved to be among the worſt ſigns when the patient complains of blindneſs; when he ſwallows with difficulty, or cannot put out his tongue when deſired to do it; when he can lie on his back only, and pulls up his knees; or when inſenſible he endeavours to uncover his breaſt, or makes frequent attempts to get out of bed without aſſigning any reaſon. If to any of theſe are added ichorous, cadaverous, and involuntary ſtools, it is a ſign of a mortification of the bowels and approaching death. It will not ſeem ſtrange to find moſt of theſe prognoſtics common to the advanced ſtate of other fevers, when we conſider, that from whatever cauſe fevers begin, by a long continuance the humours are corrupted, and the brain and nerves affected much in the ſame manner as in thoſe which ariſe from infection.

Prevention and cure. As diſtempers of the putrid kind never ariſe without an infection received from ſome quarter or other, the methods of prevention muſt evidently be reduced to two general heads. 1. To avoid receiving the infection into the body; and, 2. To put the body in ſuch a ſituation as may enable it to reſiſt the infection when received. On both theſe methods ſcarce any writer hath equalled Dr Lind of Haſler, whoſe opinions and directions therefore we ſhall give pretty fully.

As putrid diſeaſes are very common and violent in the hot countries, it is very neceſſary for Europeans who viſit theſe climates to be well informed, in the firſt place, of the ſigns of an unhealthy country, that they may be upon their guard as ſoon as they enter any foreign region. Theſe ſigns are by our author enumerated as follows.

1. A ſudden and great alteration in the air, at ſunſet, from intolerable heat to a chilling cold. This is perceived as ſoon as the ſun is down, and is for the moſt part accompanied with a very heavy dew: it ſhows an unhealthy ſwampy ſoil, the nature of which is ſuch, that no ſooner the ſun-beams are withdrawn, than the vapours emitted from it render the air damp, raw, and chilling, in the moſt ſultry climates; ſo that even under the equator, in ſome unhealthy places, the night-air is very cold to a European conſtitution. Typhus.

2. Thick noiſome fogs, chiefly after ſunſet, ariſing from the valleys, and particularly from the mud, ſlime, or other impurities. It hot climates, the ſmell of theſe fogs may be compared to that of a new cleaned ditch. Diſeaſes therefore, ariſing from this cauſe, generally take place in the night, or before ſun-riſing.

3. Numerous ſwarms of flies, gnats, and other inſects which attend ſtagnated air and unhealthy places covered with wood.

4. When all butchers meat ſoon corrupts, and in a few hours becomes full of maggots; when metals are quickly corroded on being expoſed to the air; and when a corpſe becomes intolerably offenſive in leſs than ſix hours; theſe are proofs of a cloſe, hot, and unwholeſome country. And in ſuch places, during exceſſive heats and great calms, it is not altogether uncommon for Europeans, eſpecially ſuch as are of a groſs habit of body, to be ſeized at once with the moſt alarming and fatal ſymptoms of what is called the *yellow fever*, without even any previous complaint of ſickneſs or other ſymptoms of the diſeaſe. There has firſt been perceived an uneaſy itching ſenſation, commonly in the legs; and upon pulling down the ſtockings, ſtreams of thin diſſolved blood followed, a ghaſtly yellow colour quickly diffuſed itſelf over the whole body, and the patient has been carried off in leſs than forty-eight hours.

5. A ſort of ſandy ſoil, commonly a ſmall, looſe, white ſand, as that at Penſacola, Whydah, and the iſland of Bonaviſta, which is found by experience to be injurious to health. The peſtiferous vapour ariſing, during the ſummer months and in the heat of the day, from ſuch a ſandy ſoil, is beſt characteriſed by its effects in the extenſive deſarts of Aſia and Africa. It there conſtitutes what is called the *Semiel-wind*; a blaſt which, in the parched deſart, proves inſtantly fatal both to man and beaſt: but when it paſſes over a ſoil well covered with graſs and vegetables, has its effects greatly mitigated; it is, however, even then, productive of ſickneſs: thus the ſoutherly winds, while they blow from the deſarts of Libya during the ſummer, at Algiers, Tunis, and Tripoli, produce an unhealthy ſeaſon; and at Madras the winds, which, in the months of April and May, paſs over a large tract of ſand, are always hot, diſagreeable, and unwholeſome.

During theſe land-winds, ſudden guſts of a more hot and ſuffocating nature are often obſerved to come from theſe ſands once or twice, or even more frequently, in a day, which ſeem to be this vapour in a purer form. Theſe guſts paſs very quickly, and affect perſons who happen to ſtand with their faces towards them in the ſame manner as the hot air which iſſues from a burning furnace, or from a heated oven, and obliges them immediately to turn away from it in order to recover breath. The effect of this hot ſuffocating blaſt or vapour on the human body, even when mitigated by paſſing through a moiſt atmoſphere, is the ſame as that of intenſe cold; it ſhuts up every pore of the ſkin, and entirely ſtops the perſpiration of ſuch

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as are exposed to it. These blasts come only in the day time, and always from the desarts. Water is the only known corrector or antidote against them: hence, coarse thick clothes, kept constantly wet, and hung up at the windows or doors, greatly mitigate their violence. A house so built as to have no windows or doors towards the desarts, is an excellent protection against their pernicious effects. The hot land-winds constantly blow at Madras and other places on the coast of Coromandel, at that season, from midnight till noon: the sea-breezes then begin, which relieve the difficulty in breathing, and the obstructed perspiration which the former occasioned.

That the heat of these land-winds, as also of the sudden gusts which accompany them, proceed from large tracts of sand heated by the sun, is evident from the increased heat and suffocating quality of these winds, in proportion as the day advances, and as the heat of the season is increased. The opposite winds, blowing from each side of the Balagate-mountains, are a farther proof of this. These mountains, running from north to south divide the hither Peninsula of India into two unequal parts, and separate what is called the *Malabar* from the *Coromandel* coast. To the former they are very near, but at a great distance from the latter. The winds blowing from those hills are on the Malabar-coast always remarkably cool; but on the coast of Coromandel, in the months of April, May, June, and July, are extremely hot and suffocating, as they pass over a large tract of intermediate sand, heated during those months by an almost vertical sun. Hence the Malabar coast is always covered with an agreeable verdure; whereas the Coromandel coast during the continuance of these cool winds, seems a barren wilderness, nothing appearing green except the trees. On the contrary, the winds that pass over these sands, after being wet with the rains, are the coldest which blow at Madras. Bottles of liquor inclosed in bags of coarse cloth, kept constantly wet, and suspended in the shade, where those hot winds may have access to them, become as cold as if they had been immersed in a solution of nitre; an effect owing undoubtedly to the constant evaporation of water from the surface.

It is an observation of the natives on the coast of Coromandel, which is confirmed by the experience of many Europeans, that the longer the hot land-winds blow, the healthier are the ensuing months; these winds, as they express it, purifying the air. Are not the winds therefore the cause why the air on the coast of Coromandel, except during their continuance, is more healthy than in other parts of India where these winds do not blow? Does not this also suggest a very probable reason, why the plague in Egypt generally ceases in the beginning of June; the periodical hot winds which come from the desarts of Nubia and Ethiopia having then rendered the air of Egypt pure and wholesome? Many have ascribed that effect to the north-winds; as the plague not only ceases when they blow, but all infected goods, household-furniture, and wearing apparel, are then said to become entirely free from the contagion: these, however, cannot be the cause, as the most destructive plague is abated in its violence, if not wholly eradicated, before they set in. With equal propriety we may reject the opinion that the overflowing of the Nile is productive of that salutary effect, as the plague generally ceases before the increase of that river is perceptible.

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Thus the plague, the greatest calamity which can afflict mankind, seems to be destroyed by those hot winds, which are otherwise so pernicious to animal and vegetable life. And although, during the continuance of these winds, the most fruitful fields wear the aspect of a parched desart, yet no sooner the rains fall, but vegetation is restored, the plants revive, and beautiful verdure is again spread over the face of the country.

Having thus given an account of the signs of an unhealthy country, Dr Lind next proceeds to mention such employments as are particularly dangerous to Europeans on their first arrival. One of these is the cutting down of trees, shrubs, &c. or *clearing the ground*, as it is called. Of the unhealthiness of this employment he gives two instances. At the conclusion of the late peace, the captain of a ship of war went on shore at the island of Dominica, with 12 of his men, to cut down the wood, and to clear a piece of ground which he intended to have purchased: but, in a few days, sickness obliged him to desist from this dangerous work; the captain and 11 of his men being seized with violent fevers, which terminated in obstinate intermittents, and of which several died. The survivors suffered so much in their constitutions, that, even after they came to England, the return of an east wind was apt to bring on a violent fit of the ague. The Ludlow-Castle, a ship of war of 40 guns, in a voyage to the coast of guinea, also lost 25 of her men at Sierra Leona, who were employed in cutting down wood for the ship. This is an occupation which has often proved destructive to Europeans in those climates, and in which they ought never to be employed, especially during the rainy season. There being numberless instances of white persons, when cutting down the woods at that season, who have been taken ill in the morning, and dead before night.

Another evil, less known, and less suspected, but no less dangerous, is the sending of Europeans in open boats after sunset, where the soil is swampy, or where there are great night-fogs. The single duty alone of fetching fresh-killed butchers meat at night for the use of our ships companies in the East and West Indies, has destroyed every year several thousand seaman. In those parts of the world, butchers meat must be brought on board at night immediately after it is killed, otherwise it will not be fit for use the next day; but a contract made with the natives to send it on board at that time, which might be done for a trifling sum, would be the means of preserving many useful lives. During the sickly season at Batavia, a boat belonging to the Medway, which attended on shore every night, was three times successively manned, not one having survived that service. They were all taken ill in the night, when on shore, or when returning on board; so that at length the officers were obliged to employ none but the natives on that business. Great numbers of men have perished from being employed in this manner at Bengal, where the European ships often anchor in the most unhealthy spots of the river; and even when the great night-fogs arise, after the rainy season, the men are often obliged to perform such night-services in boats.

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Burying the dead in ſwampy countries is another occupation which has proved fatal to many, and which ought to be entruſted to negroes or the natives of the country. The effluvia from the ground when newly opened, whether from graves or ditches, are far more dangerous than from the ſame ſwampy ſoil when the ſurface is undiſturbed; nay, in ſome places, it has been found almoſt certain death for an European to dig a grave, unleſs long ſeaſoned to the country. In ſuch a place, the attendance of friends at funerals ought to be diſpenſed with.

In all caſes where it is practicable, the ſhips which viſit theſe unhealthy countries ſhould anchor at as great a diſtance as poſſible from ſhore; or if obliged to anchor near marſhy grounds or ſwamps, eſpecially during ſummer or in hot weather, and when the wind blows directly from thence, the gun-ports which would admit the noxious land-breeze ought to be kept ſhut, eſpecially at night. Or if the ſhip rides with her head to the wind, a thick ſail ought to be put upon her foremaſt, along which the ſmoke from the fire-place might be made conſtantly to play and aſcend. If the ſail ſhould occaſion a little ſmoke between decks, this inconvenience will be ſufficiently compenſated by its keeping off the direct ſtream of the ſwampy ſhore effluvia; which now being obliged to form a curve before they reach the more diſtant parts of the veſſel, muſt needs be greatly diverted and ſcattered.

The beſt preſervative againſt the miſchievous impreſſions of a putrid fog, or of a marſhy exhalation, is a cloſe, ſheltered, and covered place; ſuch as the lower apartments in a ſhip, or a houſe in which there are no doors or windows facing the ſwamps. If in ſuch places a fire be kept either at the doors and other inlets to a houſe, or in the chambers, as is practiſed in ſome unhealthy countries during the rainy or foggy ſeaſon, it will prove an excellent and effectual protection againſt the injuries of a bad air. On board of ſhips alſo fires may be made at the hatchways; and of the good effects of this we have the following example. When the Edgar, a ſhip of war of 60 guns, was upon the coaſt of Guinea in the year 1768, her men were very ſickly, and many of them died: however it was obſerved, that in a ſloop of war, which was conſtantly in company with her, few were taken ill, and not one died during the whole voyage. This could be aſcribed to no other cauſe, but that in the ſloop the fire-place for cooking victuals was on the ſame level with the deck where the men lay; and every morning when the fire was lighted, eſpecially when there was but little wind, the ſmoke from the cook-room ſpread itſelf all over the ſhip, and particularly over thoſe parts where the men lay; but from the conſtruction of the fire-place of the Edgar, no ſmoke from it ever came between her decks.

Perſons on board any ſhip whatever, are much more ſafe, and their ſituation is much preferable to that of thoſe who make diſtant inland excurſions in ſmall boats upon the rivers, and who are for the moſt part ignorant of the cauſe of thoſe maladies which deſtroy them. The intolerable heat at noon often obliges ſuch perſons to go in a manner half-naked; while a free and plentiful perſpiration iſſues from every pore. A near approach to putrid ſwamps at this time is apt to produce an immediate ſickneſs, vomiting, and afterwards a low nervous or malignant fever. But if they happen to paſs them at night, or lie near them in an open boat, the air from thoſe ſwamps is perceived to be quite chill and cold; in ſo much that warm thick clothing becomes abſolutely requiſite to guard the body againſt the impreſſions of ſo great an alteration in the air, and againſt its cold and inclement quality: for the effects of it then, even on the moſt healthy and vigorous conſtitution, is frequently a chilling cold fit of an ague, terminating in a fever with delirium, bilious vomitings, a flux, or even death itſelf. Typhus.

But where ſuch expoſure becomes unavoidable, the only method is then to defend the body as much as poſſible againſt the pernicious miaſmata with which the air abounds. All thoſe who are employed in cutting down woods, or in other laborious and dangerous ſervices in hot climates, during the heat of the day ought to have their heads covered with a bladder dipt in vinegar, and to waſh their mouths often with the ſame liquor; never to ſwallow their ſpittle, but rather to chew a little rhubarb or ſome other bitter, and ſpit it out frequently; to ſtop their noſtrils with a ſmall bit of linen or tow dipped in camphorated vinegar; and to infuſe ſome bark, garlic, and rhubarb, in brandy, of which a dram is to be taken, either by itſelf or diluted with water morning and evening.

In the evening before ſunſet they ſhould leave off work, and not return to their labour in the morning till the ſun has diſperſed the unwholeſome dews and vapours. Thoſe who muſt of neceſſity remain on ſhore, and ſleep in dangerous places, muſt take care not to ſleep upon the ground expoſed to the dews, but in hammocks in a cloſe tent, ſtanding upon a dry ſand, gravel, or chalk, near the ſea ſhore, and where there is no ſubterraneous water for at leaſt four feet below the ſurface of the ground. The door of this tent ſhould be made to open towards the ſea; and the back part of it, which receives the land breeze, muſt be well ſecured by double canvas, or covered with branches of trees. But in ſuch circumſtances, a hut, when it can be procured, is preferable to a tent, eſpecially if it be well thatched, ſo as to prove a defence both againſt the exceſſive heat of the ſun by day, and the noxious dews which fall at night. Here the men may be enjoined to ſmoke tobacco. When the air is thick, moiſt, and chill, the earth being overſpread with cold dew, a conſtant fire muſt be kept in and about the tent or hut, as the moſt excellent means of purifying ſuch unwholeſome air, and of preſerving the health of thoſe who either ſleeping or waking are expoſed to its influence. The centinels who guard the water-caſks, ought likewiſe at ſuch a time to have a fire burning near them. All old and forſaken habitations, natural caves and grottos in the earth, where the men may be induced to take up their abode, muſt before their admiſſion be perfectly dried and purified with

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with ſufficient fires. Fire and ſmoke are undoubtedly the great purifiers of all tainted and unwholeſome air, and the moſt excellent preſervatives againſt its noxious influence. It is the cuſtom of the negroes in Guinea, and alſo of ſome Indians (who both ſleep for the moſt part on the ground), to have a fire producing a little ſmoke, conſtantly burning in their huts where they ſleep. This not only corrects the moiſture of the night, but alſo, by occaſioning more ſmoke than heat, renders the damp from the earth leſs noxious; of which Dr Lind gives the following remarkable inſtance. A Guinea ſhip being up one of the rivers for the ſake of trade, it was found to be very dangerous to ſleep on ſhore; without which their trade could not be ſo conveniently carried on. Firſt the captain, then the mate, and two or three of the ſeamen, were taken ill; each of them the morning after they had lain on ſhore. By theſe accidents the men were greatly intimidated from lying aſhore; till the ſurgeon boldly offered to try the experiment on himſelf. Next morning when he waked, he found himſelf ſeized, as the reſt, with a giddineſs and pain in the head, &c. He immediately acquainted one of the negroes with his condition, who carried him to his hut, and ſet him down in the ſmoke of it; when his giddineſs and ſhiverings ſoon left him. He then took a dram of the bark bitter; and found himſelf greatly relieved, eſpecially by breathing ſome time in the ſmoke.—Thus inſtructed by the negro, he ordered a large fire to dry the hut he ſlept in; and afterwards had every night a ſmall fire ſufficient to raiſe a gentle ſmoke, without occaſioning a troubleſome heat: and by this means he and ſeveral others, uſing the ſame precautions, ſlept many nights on ſhore without any inconveniencence.

Fire and ſmoke indeed are found to be certain correctors, or rather deſtroyers, of infection in all caſes, whether ariſing from the noxious effluvia of marſhes, or from the contagion of diſeaſed bodies. Even thoſe moſt extraordinary and fatal damps called *harmattans*, are unable to reſiſt the ſalutary effects of ſmoke. In other caſes, Dr Lind remarks, that, under ſome circumſtances, the ſource of an infection in a ſick chamber or any other place, may be removed or deſtroyed by accidental means, for which we cannot account, and which we often cannot aſcertain. But it oftener happens, that it is very difficultly rooted out; and that exact cleanlineſs, with the benefit of a pure air, often proves inſufficient to remove the evil. Smoke, however, has never been known to fail. It is not to be doubted, that excepting the true plague, there has been an infection fully as peſtilential and as mortal in ſome ſhips as in any other place whatever; yet it has never been heard, that any ſhip, after having been carefully ſmoked, did not immediately become healthy: and if afterwards they turned ſickly, it was eaſy to trace that ſickneſs from other infected ſhips, jails, and the like places.

There are three methods practiſed for purifying veſſels after the men have been removed out of them. The firſt is by burning of tobacco. A quantity of tobacco is ſpread on ſeveral fires, made with ſuch old pieces of rope as are called *junk*. Theſe are diſperſed into different places of the ſhip, and their heat and ſmoke afterwards cloſely confined below for a conſiderable time.—The ſecond method is by charcoal fires ſtrewed with brimſtone. The heat and ſteam of theſe burning materials muſt alſo be long and cloſe ſhut up: but, although this fume, properly applied, has been found by experience to purify moſt effectually tainted apartments, ſhips, clothes, &c. yet there are ſome kinds of vermin which it will not deſtroy, particularly lice. The third method of purification is performed by the addition of arſenic to the materials of the ſecond proceſs, in the following manner. After carefully ſtopping up all the openings and every ſmall crevice of the ſhip (as was alſo neceſſary in the preceding proceſſes), a number of iron pots, properly ſecured, are to be placed in the *hold*, *orlope*, *gun-deck*, &c. Each of theſe are to contain a layer of charcoal at the bottom, then a layer of brimſtone, and ſo alternately three or four layers of each, upon which the arſenic is to be ſprinkled, and on the top of it ſome oakum dipped in tar is to be laid to ſerve as a match. The men, upon ſetting fire to the oakum, muſt ſpeedily leave the place, ſhutting cloſe the hatchway by which they came up.

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From the known and experienced efficacy of theſe proceſſes, it appears, that fire and ſmoke are the moſt powerful agents for annihilating infection; and, it may be preſumed, even the plague itſelf. This is in ſome meaſure agreeable to what we learn from the ancient records of phyſic. But the prepoſterous uſe, or rather abuſe, of fire on ſuch occaſions, has cauſed its effects to be diſregarded by ſome, and to be ſuſpected of miſchief by others. The modern practice of burning large fires in the open air, in the ſtreets, and about the walls of towns infected with the plague or other contagion, is founded on principles groundleſs and erroneous; and has therefore been found by experience not only unſucceſsful, but hurtful. But though this muſt be allowed, it doth not thence by any means follow, that when once a houſe hath been infected, and the patients removed from it, the doors and windows at the ſame time being ſhut, that ſuch fires will then prove hurtful; or that, by this method of purification, all the ſeeds of contagion will not be effectually deſtroyed. Whenever, therefore, perſons die of a ſpotted fever, a malignant ſore throat, the ſmall-pox, or any diſtemper found to be communicable from the ſick to others, the corpſe ought quickly after death to be removed into another room; that in which the perſon died ſhould be well aired, by having the windows opened, till a charcoal-fire be kindled, with ſome rolls of ſulphur upon it; after which, both doors and windows ſhould be kept ſhut for a conſiderable time, not leſs than eight or ten hours, till the room be thoroughly ſmoked. In ſeveral ſhips, where there are the faireſt opportunities of trying and judging things of this nature, the contagion of the ſmall-pox has been entirely ſtopped by wood-fires, ſprinkled with brimſtone, kept burning and cloſely confined in the infected place. In a word, a judicious and proper application of fire and ſmoke is the beſt means for the deſtruction and utter extinction of the moſt malignant ſources of diſeaſe; and they are beſides the greateſt purifiers of all bad and tainted air.

Next to the ſmoke of wood for purifying a tainted air, that of gun-powder is to be eſteemed the beſt; and it has this further good property, that it is entirely inoffenſive to the lungs. The caſcarilla-bark, when burning, gives a moſt agreeable ſcent to the chamber of the ſick; ſo is at leaſt an elegant preſervative, and may

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prevent bad ſmells from taking effect. The ſteam of camphorated vinegar warmed, is ſtill more powerful for this purpoſe. But, beſides correcting the ill quality of the air, and purifying the chamber, another good effect is produced from ſuch ſteams and ſmoke as are inoffenſive to the lungs. As ſoon as the vapour becomes denſe, the nurſes and patients become deſirous of the admiſſion of freſh air by the door or windows. Now it is certain, that the air in the chambers of the ſick cannot be too often changed, provided the patient be well covered, and the curtains of his bed, if neceſſary, be drawn cloſe. No argument is ſo forcible to obviate the danger of foul air in a room or ward (occaſioned by the obſtinacy of nurſes or relations), as ordering it to be frequently fumigated or ſmoked: A practice more frequent in other countries than in this, but of great benefit to the ſick.

Laſtly, with regard to the method of purifying goods, moveables, clothes, &c. which are ſuppoſed to harbour infection, it muſt be obſerved, that the uſual cuſtom of only unpacking and expoſing ſuch materials to the open air, is in many inſtances inſufficient to deſtroy the latent ſeeds of diſeaſe. It is certain indeed, that in moſt caſes the contagious particles are more readily and fatally communicated from the clothes of a ſick perſon than from his body. The ſpreading abroad, therefore, of contaminated clothes to dry or to be aired, without a previous fumigation of them, may be of dangerous and fatal conſequence. All ſuch ſuſpected ſubſtances ſhould be firſt fumigated in a cloſe place, and in the ſame manner as an infected chamber, after which they may be ſpread abroad and expoſed to the air. In infectious diſeaſes, eſpecially fevers, the linen of the ſick, or ſuch clothes about them as will admit of being waſhed, ought never at firſt to be put in warm water, as it is dangerous to receive the ſteam that may hence ariſe. It is neceſſary to ſteep them firſt either in cold water or in cold ſoap-lees for ſeveral hours, that the filth may be waſhed off.

We muſt now proceed to give an account of the method of cure, after the methods of preventing the infection from being received into the body have either been neglected or proved ineffectual. Here it is of the utmoſt importance to take the diſeaſe in the very beginning, before it hath time to corrupt the fluids to ſuch a degree as to endanger life. In theſe ſlight degrees of infection, a vomit properly adminiſtered, eſpecially if ſucceeded by a bliſter, never fails to remove the diſorder, and prevent the fever which would otherwiſe unavoidably follow. Of this Dr Lind gives the following inſtances. A lady afflicted with the bilious cholic, had intolerably fetid diſcharges of corrupted matters upwards and downwards. A gentlewoman, only in paſſing the room, was immediately ſeized with a retching and ſickneſs, which continued 24 hours. The nurſe who attended was ſuddenly ſeized with a giddineſs and vomiting from the bad ſmell, which, as ſhe expreſſed it, reached into her ſtomach. The vomiting became more ſevere at night, accompanied with a purging and frequent ſhiverings. By means of an emetic both evacuations were ſtopped: notwithſtanding which, for ſome days afterwards, ſhe continued to have frequent tremors, and a violent head-ach, with a low irregular pulſe; and did not recover ſo ſoon as the patient.

Typhus.

Such ſlight degrees of infection have been often obſerved to be derived from patients of a groſs habit of body when labouring under inflammatory diſtempers, and even other complaints. A man was ſent to Haſlar Hoſpital ſuppoſed to have a fever. He was furiouſly delirious, with a quick full pulſe. Notwithſtanding plentiful evacuations, this delirium continued for two months with ſhort intervals; when the caſe was found to be plainly maniacal. A nurſe, upon raiſing this perſon up in her arms, perceived an intolerably bad ſmell, and was inſtantly ſeized with ſhiverings, ſickneſs, and head-ach. Finding herſelf very ill, ſhe took a vomit in ſix hours afterwards, and paſſed the night in profuſe ſweats by means of a ſudorific draught. Next morning the violence of the head-ach was but little abated; upon every attempt to move, ſhe complained of a burning heat and pain in her forehead, and became giddy. Her inclination to drink was frequent, and her pulſe low and quick. A bliſter was immediately applied to the back; as ſoon as the bliſter took effect, the head-ach and thirſt entirely left her, and the pulſe was calm. Next day ſhe aroſe and was well.

Many ſimilar inſtances of infection have been obſerved from putting the dead into their coffins. In particular, one man, who, from performing that duty to his meſſmate, was ſo ill, even after the operation of the vomit, as to require a bliſter. In the courſe of one week two nurſes were infected by a perſon in the ſmall-pox. Both were ſeized in like manner with ſhiverings, ſickneſs, and head-ach; the one upon receiving the patient's breath, the other upon making his bed. In the one, a pain darted into her breaſt; in the other, into the breaſt and in the ſmall of the back. The complaints of the former were ſpeedily removed by a vomit, though ſhe continued to have irregular returns of ſhiverings for three days afterwards. But in the latter, though the head-ach, ſickneſs, and rigors, were greatly abated by the vomit, yet a conſtant heat and thirſt, with a low pulſe, and a violent pain in the breaſt, indicated the neceſſity of applying a bliſter to the affected parts, which next morning removed all her complaints.

A perſon is often immediately ſenſible of his having received an infection from the firſt attack: they generally compare the firſt impreſſion to an earthy, diſagreeable ſmell, reaching down as they expreſs it, into their throats, as from a grave newly opened, but not quite ſo raw as the cadaverous ſtench; and the effects of it, ſhivering and ſickneſs, are inſtantaneous. It is a ſmell difficult to deſcribe; but it is well known to the nurſes and attendants about the ſick, as it uſually accompanies fevers of extreme malignity, and, with the peculiar diſcharges from the bliſtered parts, may be reckoned among the moſt conſtant ſymptoms of a bad fever. Some compare the ſmell to that of rotten ſtraw. It often reſembles the diſagreeable ſmell of a perſon labouring under the confluent ſmall-pox at their turn, though not ſo ſtrong. One perſon, on receiving the infection, was ſenſible of ſomething like an electric ſhock through his body. But many are not ſenſible of any effect from an infection at firſt; and an infection from a fever will ſometimes continue for many days, nay weeks, diſcovering itſelf chiefly by irregular ſhiverings, ſometimes ſo ſevere as to oblige the patients to have

Febres. recourse to their beds once or twice a-day; sometimes every other day. Among a number thus affected, it also appears, that such as are put into unseasoned chambers, or have sat down on the cold ground, lain in raw damp apartments, &c. are immediately seized with a sickness at stomach, sometimes with a dangerous purging, and often with fevers accompanied with bad symptoms, which others have entirely escaped.

It now remains to consider the proper method of curing putrid fevers, on the supposition that the infection has been allowed to operate till the blood becomes radically tainted, and of consequence the nervous system effected to such a degree, that its power cannot be restored by any of the simple medicines abovementioned. Here all authors agree, that a change of air, when it can be effected, is absolutely necessary, and often contributes more towards the removing of the disease than all the medicines than can be exhibited. The utility of this change will appear from what hath been formerly said; and we shall only further allege one instance from Dr Lind, in which the effects of bad air appear to a degree almost incredible. "It is remarkable (says he), that in the last war, the English ships which touched at Batavia suffered more by the malignant and fatal diseases of that climate, than they did in any other part of India, if we except a fatal scurvy which once raged in that fleet at sea. Soon after the capture of Manila, the Falmouth, a ship of 50 guns, went to Batavia, where she remained from the latter end of July to the latter end of January; during which time she buried 100 soldiers of the 79th regiment and 75 of the ships company; not one person in the ship having escaped a fit of sickness, except her commander Captain Brereton. The Panther, a ship of 60 guns, was there in the years 1762 and 1764; and both times during the rainy season. In the former of these years, she buried 70 of her men; and 92 of them were very ill when she left the place. In the year 1764, during a short stay, 25 of her men died. The Medway, which was in company with her, lost also a great number of men. Nor was the sickness at that time confined to the ships; the whole city afforded a scene of disease and death: streets crowded with funerals, bells tolling from morning to night, and horses jaded with dragging the dead in hearses to their graves. At that time a slight cut of the skin, the least scratch of a nail, or the most inconsiderable wound, turned quickly to a spreading putrid ulcer, which in 24 hours consumed the flesh even to the bone. This fact is so extraordinary, that, upon a single testimony, credit would hardly be given to it; yet on board the Medway and Panther they had the most fatal experience of it, and suffered much from it."

But where a change of air is impracticable or ineffectual, and where the fever hath already made some progress, Sir John Pringle generally took away some blood if the pulse was full. When the symptoms run high, a plentiful evacuation of that kind seemed indicated; yet it was observed that large bleedings generally did harm, by sinking the pulse, and affecting the head. Nor was a moderate bleeding to be repeated without caution; even those whose blood was sizy, unless their lungs were inflamed, were the worse for a second bleeding. If the head only suffered, it was much safer to use leeches than to open a vein in the arm; but in the delirium with a sunk pulse, even leeches were hurtful. Many recovered without letting blood, but few who lost much of it. Typhus.

Vomits also must be used with caution; for though they may be of use by way of prevention, yet in the advanced state of the disease, when the patient has all along complained of sickness at stomach, they are evidently unsafe. Here the antiseptic quality of fixed air is of much use, and the neutral draughts given in the act of effervescence are generally attended with happy effects. Nay, clysters of fixed air itself have been found very serviceable. Even in very bad stages of the distemper, where a putrid and colliquative looseness has taken place, clysters of fixed air have been known to alleviate the symptoms. We must not, however, put too much confidence in medicines of this kind. Mild astringent cordials, especially wine and Peruvian bark, are the only resources in these disorders. Concerning the former, Sir John Pringle observes, in the low state of these fevers, and in great sinkings, which either come after unseasonable bleedings or long want of nourishment, it was a most grateful and efficacious cordial, to which nothing was comparable. The common men had an allowance, from a quarter to half a pint in a day, of a strong kind, made into whey, or added to the panada which was their ordinary food. But to others out of the hospital, he usually prescribed Rhenish or a small French wine, whereof some consumed near a quart per day, and part of that undiluted Nay, so great was the virtue of wine in this stage of the fever, that several were known to recover from the lowest condition, when refusing the bark on account of its taste, they took nothing but a little panada with wine and a volatile diaphoretic mixture every two or three hours by turns. Perhaps there is no rule more necessary in this state, than not to let the patient when low remain long without taking something cordial and nourishing; as many have been observed past recovery, by being suffered to pass a whole night without any support about the time of the crisis. In the advanced state of this fever the sick are remarkably low; and therefore Hoffman advises in such cases, that they should be constantly kept in bed, and not permitted even to sit up in it. In the last stage of this fever, as well as in that of the sea-scurvy, it would seem that the force of the heart was too small to convey the blood to the brain, except when the body is in an horizontal posture.

But, however necessary wine and the bark may be in the low stage of this fever, we must remember, that these remedies are to be administered only as antiseptics and supporters of the *vis vitæ*, without aiming at thoroughly raising the pulse or relieving the head, or at forcing a sweat by them, before nature points that way, and which Sir John Pringle seldom observed before the 14th day. For though the patient may die before that time if he has been largely bled, or if the cordial medicines have been given him too freely, yet such means as he made use of were not powerful enough to bring on a crisis sooner.

In the low state of the hospital-fever, a stupor was a constant attendant, which was very apt, in the evening, to change to a slight delirium. If this was all, as being in the common course, nothing was done. But if the delirium increased upon using wine, if the eyes

Febres. eyes looked wild, or the voice became quick, there was reason to apprehend a phrenitis; and accordingly it was observed, that at such times all internal heating medicines aggravated the symptoms; and in these cases blisters were of the greatest service. Fomentations of vinegar and warm water for the feet, our author is of opinion would answer better than either sinapisms or blisters, provided they were long enough and often enough applied. In the inflammatory fevers, he has known these fomentations have little effect for the first hour, and yet succeeded afterwards. For internal medicine the bark was omitted for some time, but the patient was continued with an acidulated drink, *viz.* barley-water and vinegar; and treated also with camphire, *pulvis contrayervæ compositus*, and nitre, as was usual in the beginning of the fever. If the delirium was of the low kind, a decoction of the bark and wine were the only remedies; for in no instance was the delirium perfectly removed till the time of the crisis. It must also be observed, that a delirium may arise in putrid fevers from two opposite errors; one from large and repeated bleedings, and the other from wine and the cordial medicines being taking too early. It appears therefore how nice the principles are that regard the cure; as neither a hot nor a cool regimen will answer with every patient, or in every state of the disease.

If a diarrhœa came on in the decline of the fever, it was moderated, but not suppressed, by adding an opiate to the usual medicines. For though the looseness may be considered as critical; yet as the sick were too low to bear evacuations, there was a necessity for restraining it in some measure; and it has often been observed, that when it has been treated in this manner, about the usual time of the crisis, the patient has fallen into a gentle sweat, which has carried off the disease. In the worst cases of this fever, and especially when it coincides with the dysentery, the stools are frequently bloody; in which dangerous state, if any thing could be done, it was attempted by medicines of the same kind. In proportion to the putrid nature of the stools, opiates and astringents were used with the greater caution.

If the disease terminate in a suppuration upon one of the parotid glands (for the gland itself does not suppurate), the abscess was opened without waiting for a fluctuation, which might never happen; the pus being often here so viscid, that after it was ripe the part felt nearly as hard as if the suppuration had not begun.

Almost every patient, after the fever, complained of want of rest, frequently of a vertigo or confusion of the head, of a continuation of the deafness, or of other symptoms commonly called *nervous*. An opiate was then given at night; and in the day some strengthening medicines, such as the bark and the elixir of vitriol. In these cases, the bark was found not only to be the best strengthener, but the surest preservative against a return of the disease. For this last intention the convalescent was ordered about three drachms a-day for six or seven days together; and afterwards, if he remained longer in the hospital, some smaller quantity daily. But if there was any appearance of a hectic fever from an inward abscess, the case was treated accordingly. Upon comparing some of the remaining symptoms of those who recovered, with the condition of the brain in those who died and were opened, Sir John Pringle was induced to think, that some part even of that substance might suppurate, and yet the person recover. Typhus.

Sometimes the patient falls into an irregular intermittent; which, if not of a hectic nature from an internal abscess, may proceed from neglecting to clear the *primæ viæ*. For it is easy to conceive, that after a long fever of such a putrid nature, often attended with langour of the bowels, the fæces may be so much accumulated, and so corrupted, as to occasion new disorders. In such cases, after proper evacuation by a purge, the bark was almost an infallible remedy.

The *Yellow* Fever.

Typhus cum flavedine cutis.

Typhus icteroides, *Sauv.* sp. 7.

Febris flava Indiæ Occidentalis, Warren. Malignant fever of Barbadoes, *Hillary's* Diseases of Barbadoes. *Lining* on the yellow fever of South Carolina, Edin. phys. and liter. Essays, vol. ii. *Mackittrick* de febre flava Indiæ Occidentalis, Edin. 1766. 162

Description. This is one of the most fatal diseases to which the inhabitants of warm climates are subject, and is the same with that called, from one of its worst symptoms, the *black vomit*, which is so terribly destructive in some of the warm parts of America, particularly at Carthagena. According to Dr Hillary, the yellow or putrid fever most commonly seizes the patient at first with a faintness, then with a sickness at stomach, accompanied mostly with a giddiness of the head; soon after with a slight chillness and horror, very rarely with a rigor, which is soon followed by a violent heat and high fever, attended with acute darting pains in the head and back. A flushing in the face, with an inflamed redness and a burning heat in the eyes, great anxiety and oppression about the præcordia, are the pathognomonic signs of the distemper; especially when attended with sickness at stomach, violent retchings, and bilious yellow vomitings, with frequent sighing. The pulse is now generally very quick, high, soft, and sometimes throbbing, but never hard: in some it is very quick, soft, low, and oppressed; the respiration quick, full, and sometimes difficult; the skin very hot, and sometimes dry, though more frequently moist. Blood taken from the patient, even at the very beginning of the disease, is often of an exceedingly florid red colour; much rarefied and thin, and without the least appearance of size; and the crassamentum, when it has stood till it is cold, will scarce cohere, but fluctuates; the serum is very yellow.

Most of the abovementioned symptoms continually increase, and are much aggravated; the retching and vomiting become almost incessant; the anxiety great, and sighing frequent; great restlessness; continual tossing; no ease in any posture; little sleep, and that disturbed and uneasy, and without any refreshment to the sick: and when they are fainting, they turn yellow about the face and neck, instead of turning pale; and as the fainting goes off, they recover their natural colour. These symptoms generally continue to the third day, though sometimes not longer than the first or second, in others to the end of the fourth: the first shows the greater dissolution of the blood, and the greater malignity of the disease; the last, the contrary; which

Febres. which the improper manner of treating the diſeaſe ſometimes haſtens and increaſes, or the proper method retards. This may be called the firſt ſtadium of the diſeaſe, and generally ends on the third day.

Blood taken from the ſick on the ſecond or third day, is much more diſſolved, the ſerum more yellow, and the craſſamentum florid, looſe, ſcarce cohering, but undulates like ſizy water when ſhaken, and ſometimes has dark blackiſh ſpots on its ſurface, ſhowing a ſtrong gangreneſcent diatheſis.

About the third day, the pulſe, which was quick and full before, now generally ſinks greatly, and becomes very low: though ſometimes it remains very quick, yet in others it is not much quicker than when the patient is in health, but is always low; the vomiting becomes almoſt inceſſant if not ſo before, and the matter thrown up is black; the patient then becomes comatoſe, with interrupted deliria. The thirſt in ſome is very great, in others but little; the pulſe ſtill low and quick, attended with cold clammy ſweats, and ſometimes with deliquia. The eyes, which were inflamed and red before, and began to be of a more duſkiſh colour, now turn yellow; and this yellowneſs alſo ſoon after appears round the mouth, eyes, temples, and neck, and in a ſhort time diffuſes itſelf all over the body. But this yellowneſs is ſo far from being always an encouraging prognoſtic, as ſome would have it, that it moſt commonly proves a mortal ſymptom. Sometimes indeed, though ſeldom, this ſuffuſion of bile upon the ſurface has proved critical; but then it did not come on till the eighth or ninth day, nor appear till the coma and all the other bad ſymptoms began to abate; and then in proportion as the yellowneſs increaſes, all the bad ſymptoms decreaſe. But the caſe is moſt commonly quite the reverſe; eſpecially when the yellowneſs comes ſoon on: and then it is not only ſymptomatical, but uſhers in the moſt fatal ſymptoms of the diſeaſe, viz. a deep coma, a low, vermicular, and intermitting pulſe, great hæmorrhages from various parts of the body, a delirium with laborious and interrupted reſpiration, great anxiety, deep ſighing, reſtleſſneſs, a ſubſultus tendinum, coldneſs of the extreme parts firſt, and then all over the body, a faltering of the ſpeech, tremors, and convulſions, which are ſoon after followed by death. So that from the firſt appearance of the yellowneſs we may ſay the patient is in the laſt ſtage of the diſeaſe, whether it terminates in death or recovery.

It has been obſerved, that, in ſome ſtrong ſanguine conſtitutions, when the patients have not been bled to a ſufficient quantity in the beginning of the diſeaſe, the pulſe has continued full, ſtrong, and rapid, but never hard; the face flushed, eyes inflamed; the tongue dry, with great thirſt and heat, till the ſecond or laſt ſtage of the fever is come on, when the pulſe has ſuddenly ſunk, and death ſoon after enſued. Yet in others, who ſeemed to be of a plethoric habit, the tongue has been moiſt all along, though they have been delirious moſt of the time, and the heat of their ſkin and the ſtrength and quickneſs of their pulſe have continued, after the firſt ſtage of the diſeaſe was over, pretty near to that of their natural ſtate in health, till within a few hours of their death; and when they have had a coma on them, one who is not well acquainted with the nature of this diſeaſe would, from their pulſe, heat, breathing, and other ſymptoms, have taken them to be in a natural ſleep. Others, when the pulſe has begun to ſink, and the fatal period ſeemed to be juſt approaching, to the great ſurpriſe of all preſent have recovered their ſenſes, ſat up, and talked pretty cheerfully for an hour or two, and in the midſt of this ſeeming ſecurity have been ſuddenly ſeized with convulſions, which carried them off immediately. Typhus.

In the latter ſtage of this fever, the blood is ſo attenuated and diſſolved, that we frequently ſee it flowing not only out of the noſe and mouth, but from the eyes, and even through the pores of the ſkin; alſo great quantities of black, half-baked, or half-mortified blood, are frequently voided both by vomiting and by ſtool, with great quantities of yellow and blackiſh putrid bile by the ſame paſſages; and the urine, which was before of a high icteritious colour, is now almoſt black, and is frequently mixed with a conſiderable quantity of half-diſſolved blood. The pulſe, which was much ſunk before, now becomes very low, unequal, and intermitting; the breathing difficult and laborious; and the anxiety inexpreſſible: an oppreſſion with a burning heat about the præcordia comes on, tho' the extremities are cold, and often covered with cold clammy ſweats: a conſtant delirium follows; and then a total loſs of the outward ſenſes as well as the judgment, with livid ſpots in many parts of the body, eſpecially about the præcordia; and ſometimes gangrenes in other parts of the body, which are very ſoon ſucceeded by death.

In a ſhort time after death, the body appears much more full of livid, large, mortified ſpots, particularly about the præcordia and hypochondres, eſpecially the right; which parts ſeem, even from the firſt ſeizure, to be the principal ſeat of this terrible diſeaſe; and, upon opening the bodies of thoſe who die of it, we generally find the gall-bladder and biliary ducts turgid, and filled with a putrid blackiſh bile; and the liver, ſtomach, and adjoining parts, full of livid or blackiſh mortified ſpots; and the whole corpſe ſoon putrifies after death, and can be kept but a few hours above ground.

Dr Lind is of opinion, that the remarkable diſſolution of the blood, the violent hæmorrhages, black vomit, and the other ſymptoms which characterize the yellow fever, are only accidental appearances in the common fever of the Weſt Indies; that they are to be eſteemed merely as adventitious, in the ſame manner as purple ſpots and bloody urine are in the ſmall-pox, or as an hiccough in the dyſentery: like theſe they only appear when the diſeaſe is attended with a high degree of malignity, and therefore always indicate great danger. This opinion, he thinks, is confirmed by an obſervation of Dr Wind's, that in 1750 the crew of a Dutch ſhip of war were diſtreſſed by the yellow fever, accompanied with the black vomit; but when the ſhip left the harbour, and changed the noxious land-air for one more healthy, the fever continued, but was not accompanied with the black vomit.

Diſeaſes ſimilar to this fever, Dr Lind informs us, may ariſe in any part of the world where the air is intenſely hot and unwholeſome; and therefore he

Febres. treats as chimerical the notion of its being imported from one part of the world to another. An example of this happened at Cadiz in Spain, in the months of September and October 1764, when excessive heat, and want of rain for some months, gave rise to violent, epidemic, bilious disorders, resembling those of the West Indies, of which 100 persons often died in a day. At this time the winds blew principally from the south, and after sun-set there fell an unusual and very heavy dew.

This disease began commonly with alternate slight chills and heats, nausea, pains of the head, back, loins, and at the pit of the stomach. These symptoms were often followed, in less than 24 hours, with violent retchings, and vomiting of a green or yellow bile, the smell of which was very offensive. Some threw up an humour as black as ink, and died soon after in violent convulsions and in a cold sweat. The pulse was sometimes sunk, sometimes quick, but often varying. After the first day, the surface of the body was generally either cold, or dry and parched. The head-ach and stupor often ended in a furious delirium, which quickly proved fatal. The dead bodies having been examined by order of the court of Madrid, the stomach, mesentery, and intestines, were found covered with gangrenous spots. The orifice of the stomach appeared to have been greatly affected, the spots upon it being ulcerated. The liver and lungs seemed to be putrid, both from their texture and colour. The stomach contained a quantity of an atrabilious liquor, which, when poured on the ground, produced a sensible effervescence; and, when mixed with spirit of vitriol, a violent ebullition ensued. The dead bodies so quickly turned putrid, that at the end of six hours their fetor was intolerable; and, in some of them, worms were found already lodged in the stomach. His Britannic majesty's ship the Tweed being at that time in Cadiz bay, several of her men were taken ill when on shore, but by being carried on board, all of them recovered. Neither did the black vomit, or any other deadly symptom of that fever, make its appearance in any of the ships.

It has been a matter of much dispute, whether the yellow fever is of an infectious nature or not. Some time ago it became an object of consideration before the Right Hon. the Lords Commissioners of Trade and Plantations, where it was urged, among other reasons, for not removing the seat of government and justice in the island of Jamaica from Spanish Town to Kingston, that there was danger from Greenwich hospital, situated near Kingston, of an infection from the yellow fever being frequently communicated to that town. On this affair a physician was consulted, who had long practised in that island, and who gave it as his opinion, that from the yellow fever in that island there was no infection. This was the opinion not only of that gentleman, but of many others who had an opportunity of being well acquainted with this fever in Jamaica. Dr Lind, however, gives a remarkable instance of its being of an infectious nature.—A gentleman dying at Barbadoes of a yellow fever, his wearing apparel and linen, packed up in a chest, were sent to his friends at Philadelphia; where, upon opening the chest, the family were taken ill; and the clothes being unluckily hung abroad to be aired, they presently diffused the contagion of the yellow fever over the whole town, by which 200 persons died. These contradictions, Dr Lind thinks, can only be reconciled, by supposing the yellow fever in the West Indies to be sometimes of an infectious nature and sometimes not.

Typhus.

In the description of the same fever by Dr Lining, as it appears in South Carolina, there are several particulars considerably different from that by Dr Hillary. According to the former, people complained for a day or two before the attack, of a head-ach, pain in the loins and extremities, especially in the knees and calves of the legs, loss of appetite, debility, and a spontaneous lassitude. Some, however, were seized suddenly, without any such previous symptoms. After a chillness and horror, with which this disease generally invades, a fever succeeded. The pulse was very frequent, till near the termination of the fever, and was generally full, hard, and consequently strong: in some, it was small and hard; in others, soft and small; but in all those cases, it frequently varied in its fullness and hardness. Towards the termination of the fever, the pulse became smaller, harder, and less frequent. In some there was a remarkable throbbing in the carotids and in the hypochondria; in the latter of which it was sometimes so great, that it caused a constant tremulous motion of the abdomen. The heat generally did not exceed 102 degrees of Fahrenheit's thermometer; in some it was less; it varied frequently, and was commonly nearly equal in all parts, the heat about the præcordia being seldom more intense than in the extremities when these were kept covered. In the first day of the disease, some had frequent returns of a sense of chillness, though there was not any abatement of their heat. In a few, there happened so great a remission of the heat for some hours, when at the same time the pulse was soft and less frequent, and the skin so moist, that one from these circumstances might reasonably have hoped that the fever would only prove a remittent or intermittent. About the end of the second day, the heat began to abate. The skin was sometimes (though rarely) dry; but oftener, and indeed generally, it was moist, and disposed to sweat. On the first day, the sweating was commonly profuse and general; on the second day, it was more moderate: but on both these, there happened frequent and short remissions of the sweatings; at which times the febrile heat increased, and the patient became more uneasy. On the third day, the disposition to sweat was so much abated, that the skin was generally dry; only the forehead and backs of the hands continued moist. The respiration was by no means frequent or difficult; but was soon accelerated by motion, or the fatigue of drinking a cup of any liquid. The tongue was moist, rough, and white, even to its tip and edges. On the second day, its middle in some was brown. On the third day, the whiteness and roughness of the tongue began to abate. The thirst in very few was great. A nausea, vomiting, or frequent retchings to vomit, especially after the exhibition of either medicines or food, came on generally the third day, as the fever began to lessen; or rather as the fulness of the pulse, heat, and disposition to sweat, began to abate. Some indeed, but very few, on the first day, had a vomiting, either bilious or phlegmatic. Very few complained of anxiety or oppression about the præcordia

Febres. dia or hypochondria; nor was there any tension or hardness about the latter. On the first day they generally dozed much, but were afterwards very watchful. Restlessness and almost continual jactations came on the second day. A great despondency attended the sick, and the strength was greatly prostrated from the first attack. The pain in the head, loins, &c. of which they had complained before the attack, were greatly increased, and in some the pain in the forehead was very acute and darting; but those pains went generally off the second day. The face was flushed; and the eyes were hot, inflamed, and unable to bear much light. On the first day, many of them at times were a little delirious, but afterwards not until the recess of the fever. The blood saved at venesection had not any inflammatory crust; in warm weather, it was florid like arterial blood, and continued in one soft homogeneous-like mass, without any separation of the serum after it was cold. When there was any separation, the crassamentum was of a very lax texture. The stools, after the first day, were fetid, inclined to a black colour, and were very rarely bilious, soft, or liquid, excepting when forced by art; for an obstinate costiveness attended the febrile state. The urine was discharged in a large quantity, was pale, sometimes limpid, and rarely of a higher than a straw colour, except when the weather was very warm, and then it was more saturated, of a deep colour, and discharged in smaller quantities. It had a large cloud, except when it was very pale or limpid; but more generally it had a copious white sediment, even on the first day of the fever. On the second day, the urine continued to be discharged very copiously; in some it was then turbid, and deposited a more copious sediment than on the first day: this sediment was sometimes of a brownish colour; in which case it was generally followed by bloody urine, either about the end of the second or beginning of the third day.—The colour and quantity of the urine, discharged in equal times, were remarkably variable, being now limpid, then of a deeper colour, now discharged in a larger, then in a smaller quantity; which could not be ascribed to any change made either in the quantity or quality of the drink, &c.

The fever accompanied with those symptoms terminated on the third day, or generally in less than 72 hours from the first attack, not by any assimilation or coction and excretion of the morbid matter: for if by the latter, there would have been some critical discharge by sweat, urine, stool, or otherwise, none of which happened; and if by the former, nothing then would have remained but great debility. This fever, however, did not terminate in either of these salutary ways, excepting in some, who were happy enough to have the disease conquered in the beginning by proper evacuations, and by keeping up a plentiful sweat, till the total solution of the fever, by proper mild diaphoretics and diluents. But those who had not that good fortune, however tranquil things might appear at this period (as great debility, and a little yellowness in the white of the eyes, seemed then to be the chief complaint, excepting when the vomiting continued), yet the face of affairs was quickly changed: for this period was soon succeeded by the second *stadium*; a state, though without any fever, much more terrible than the first: the symptoms in which were the following. The pulse, immediately after the recess of the fever, was very little more frequent than in health, but hard and small. However, though it continued small, it became, soon afterwards, slower and very soft; and this softness of the pulse remained as long as the pulse could be felt. In many, in this stage of the disease, the pulse gradually subsided, until it became scarce perceptible; and this, notwithstanding all the means used to support and fill it; and when this was the case, the icteritious-like suffusion, the vomiting, delirium, restlessness, &c. increased to a high degree. In some, the pulse, after being exceedingly small and scarce perceptible, recovered considerably its fullness; but that favourable appearance was generally of but short continuance. The heat did not exceed the natural animal-heat; and when the pulse subsided, the skin become cold, and the face, breast, and extremities acquired somewhat of a livid colour. The skin was dry when the weather was cold, but was moist and clammy when the weather was hot. The respiration was natural, or rather slow. The tongue was moist, and much cleaner than in the former stage; its tip and edges, as also the gums and lips, were of a more florid red colour than usual. Very few complained of thirst, though they had a great desire for cold liquors. The vomiting or retching to vomit increased, and in some was so constant that neither medicines nor aliment of any kind were retained. Some vomited blood; others only what was last exhibited, mixed with phlegm; and others again had what is called the *black vomit* (A). The retching to vomit continued a longer or shorter time according to the state of the pulse; for as that became fuller, and the heat greater, the retching to vomit abated, and *è contra*. The inquietude was very obstinate; and when they dozed, their slumbers were but short and unrefreshing. There were some who were drowsy; but these always awaked, after the shortest slumbers, with a great dejection of spirits and strength. The

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(A) That which is called the *black vomit* at first sight appears to be black; but on a more careful examination, it was observed that this colour proceeded from a great quantity of small flakey black substances which floated in the liquor thrown up by vomiting; but the colour of this liquor was much the same with that which the patient had last drank, and was by no means black. Those black flakey substances are the bile mixed with, or adhering to the mucus which lined the stomach. For, upon dissection of those who died of this disease, it was always observed that the mucus of the stomach was abraded, and the bile in the cystis was black and sometimes very viscid. In a lad who died of this disease in the beginning of the fourth day, and who was immediately opened, the bile was not only black, but had the consistence of thick venice-turpentine, and was exceedingly tough. On the inside of the stomach, there were several carbuncles or gangrenous specks. And in all those who were dissected, and had died of this disease, the same appearances were not only always observed, but likewise the blood was very fluid, and the vessels of the viscera were much distended.

Febres. The jactations or restlessness were surprising: it was frequently scarce possible to keep the patients in bed; though, at the same time, they did not complain of any anxiety or uneasiness; but if asked how they did, the reply was, *Very well.* The debility was so great, that, if the patient was raised erect in the bed, or, in some, if the head was only raised from the pillow, while a cup of drink was given, the pulse sunk immediately, and became sometimes so small, that it could scarce be felt; at this time, they became cold, as in a horripilatio, but without the anserine-like skin: their lips and skin, especially about the neck, face, and extremities, together with their nails, acquired a livid colour. The delirium returned and increased; it was generally constant in those whose pulse was small and subsiding. The inflammation of the tunica conjunctiva or white of the eyes increased much, but without pain. A yellowness in the white of the eyes, if it did not appear before in the febrile state, became now very observable, and that icteritious-like colour was soon diffused over the whole surface of the body, and was continually acquiring a deeper saffron-like colour. In some indeed no yellowness was observable, excepting in the white of the eyes, until a little before death, when it increased very quickly, especially about the breast and neck. There were many small specks, not raised above the skin, which appeared very thick in the breast and neck, but less so in the extremities, and were of a scarlet, purple, or livid colour. In women the menstrua flowed, and sometimes excessively, though not at their regular period.

There was such a putrid dissolution of the blood in this stadium of the disease, that, besides the vomiting of blood formerly mentioned, and the bloody urine soon to be taken notice of, there were hæmorrhagies from the nose, mouth, ears, eyes, and from the parts which were blistered with cantharides. Nay, in the year 1739 and 1745, there were one or two instances of an hæmorrhagy from the skin, without any apparent puncture or loss of any part of the scarf-skin.

An obstinate costiveness continued in some; in others, the stools were frequent and loose; in some they were black, liquid, large, and greatly fatiguing; in others, when the stools were moderate, even though they were black, they gave great relief; in others, again, the stools nearly resembled tar in smoothness, tenacity, colour, and consistence.

The urine was discharged in a large quantity, in proportion to the drink retained by the patient: it was pale if the patient was not yellow; but if yellow, then it was of a deep saffron-colour: in either case, it had a sediment, or at least a large cloud, which remained at the bottom of the glass; in some it was very turbid; in others it was bloody: and the quantity of blood discharged with the urine bore always some proportion to the state of the pulse; when that became fuller, the quantity of blood in the urine was diminished; when the pulse subsided, the bloody urine increased, and even returned after it had ceased some days, soon after the pulse became smaller. This stage of the disease continued sometimes seven or eight days before the patient died.

When this stadium of the disease terminated in health, it was by a recess or abatement of the vomiting, hæmorrhagies, delirium, inquietude, jactations, and icteritious-like suffusion of the skin and white of the eyes; while, at the same time, the pulse became fuller, and the patient gained strength, which, after this disease, was very slowly. But when it terminated in death, those symptoms not only continued, but sooner or later increased in violence, and were succeeded with the following, which may be termed the third *stadium* of the disease, which quickly ended in death. The pulse, though soft, became exceedingly small and unequal; the extremities grew cold, clammy, and livid; the face and lips, in some, were flushed; in others they were of a livid colour; the livid specks increased so fast, that in some the whole breast and neck appeared livid; the heart palpitated strongly; the heat about the præcordia increased much; the respiration became difficult, with frequent sighing; the patient now became anxious, and extremely restless; the sweat flowed from the face, neck, and breast; blood flowed from the mouth, or nose, or ears, and in some from all those parts at once; the deglutition became difficult; the hiccoughs and subsultus of the tendons came on, and were frequent; the patients trifled with their fingers, and picked the naps of the bed-clothes; they grew comatous, or were constantly delirious. In this terrible state, some continued eight, ten, or twelve hours before they died, even after they had been so long speechless, and without any perceptible pulsation of the arteries in the wrists; whereas, in all other acute, diseases, after the pulse in the wrists ceases, death follows immediately. When the disease was very acute, violent convulsions seized the unhappy patient, and quickly brought this stadium to its fatal end. After death, the livid blotches increased fast, especially about the face, breast, and neck, and the putrefaction, began very early, or rather increased very quickly.

This was the progress of this terrible disease through its several stadia. But in hot weather, and when the symptoms in the first stage were very violent, it passed through those stages with such precipitation that there was but little opportunity of distinguishing its different stadia, the whole tragedy having been finished in less than 48 hours. It was remarkable, that, 1. The infection was increased by warm and lessened by cold weather. 2. The symptoms in the several stadia were more or less violent, according to the heat or coolness of the weather. In hot days, the symptoms were not only more violent, but in those who seemed in moderate weather to be on the recovery, or at least in no danger, the symptoms were also greatly heightened, when the weather grew considerably warmer, as frequently to become fatal. In cool days, the symptoms were not only milder, but many who were apparently in great danger in hot days were saved from the very jaws of death by the weather becoming happily cooler. 3. The disease was generally more fatal to those who lay in small chambers not conveniently situated for the admission of fresh air, to those of an athletic and full habit, to strangers who were natives of a cold climate, to those who had the greatest dread of it, and to those who before the attack of the disease had overheated themselves by exercise in the sun, or by excessive drinking of strong liquors; either of which indeed

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Febres. indeed seemed to render the body more susceptible of the infection. Lastly, the disease proved most certainly fatal to valetudinarians, or to those who had been weakened by any previous disease.

Although from the description which has now been given of the yellow fever, it may appear to be in many particulars very different from the remittent fever of warm climates; yet it is the opinion of many late writers of great accuracy, particularly of Dr John Hunter in his Observations on the Diseases of the Army in Jamaica, that it is to be considered only as a more dangerous form of the same disease. And there can be no doubt that the remittent fever not only appears in different seasons and situations with very different degrees of severity; but also that while the remittent fever prevails in its usual form in the West India islands, some individuals, particularly those who are newly arrived, will be affected with very remarkable yellowness, as well as bilious and black vomitings.

Causes of, and persons subject to, this disease. The yellow fever attacks principally Europeans, especially those who have but lately arrived in the hot climates. Negroes are entirely exempt from it, though the mulattoes and tawnies are as liable to be seized with it as the whites themselves. The cause of the disease seems to be a particular kind of contagion; but Dr Lind seems to be of opinion, that the immediate cause of the symptoms is a disposition in the glutinous part of the blood to separate from the others, and to become purulent. In some persons who have been bled in the yellow fever, the blood hath been observed prodigiously viscid; the crassamentum covered with a yellow gluten half an inch in thickness, and impenetrable to the finger unless cut by the nail; the serum being at the same time of the consistence of a thin syrup, and of a deep yellow tinge. This serum tasted bitter, and was taken for a composition of soot. The appearances on dissection, with his conclusion from them, we shall give in his own words: "In a man who died on the eleventh day of a yellow fever, whose body emitted no bad smell 36 hours after death, and was still yellow, I found all the bowels of the abdomen sound; the liver and spleen were remarkably so: as also the stomach and intestines. There was no suffusion of the bile either in the intestines or stomach. The gall-bladder, of the natural size, contained the usual quantity of bile, somewhat thicker than common, and grumous (B).

"Upon examining further, this disease was found to have lain wholly on the left side, where, within the breast, was found near a quart of yellowish water, in which were many large flakes of yellowish gluten, appearing, by comparison, precisely the same with the thick pellicle which had covered the blood taken from his arm. These flakes bore in several places a resemblance to a membranous substance beginning to be converted into a purulent jelly. The pleura, both on its inside and outside, as also its continuation, the investing membrane of the lungs (which in some parts was greatly thickened), were covered with cakes of this gluten, hanging in some places loosely, in others adhering more strongly; and all in different states of yellow or purulent corruption. The right cavity of the breast, and all the other parts of his body, were found entirely free from disease. Typhus.

"His complaints had been chiefly in his breast; and a small quantity of blood, taken from him two days before his death, was covered with an impenetrable, yellow, thick gluten; the red portion below it being quite loose.

"In those fevers, I have also seen the disease entirely confined to the heart and pericardium. In one who died the tenth day of the fever, without having been yellow, a quantity of pus and purulent crusts were found mixed with the water of the pericardium. The heart in different places was excoriated; and, together with the inside of the pericardium, was lined with a thick membranous cake, similar to that already mentioned on the lungs and pleura. In some places this cake had a purulent, in others a gelatinous, appearance, exactly resembling the coagulum of the blood. His complaints had been, a great oppression on the breast, and an extreme difficulty of breathing. In a third person, who died on the thirtenth day of the fever, above two quarts of pus and purulent jelly were found in the cavity of the belly. The source of such an extraordinary quantity of matter was not from any preceding inflammation, nor any imposthume, that we could discover; but from innumerable ulcerations on the surface of the intestines, omentum, mesentery, an peritoneum. Neither did those ulcerations (or excoriations, as they rather appeared in several places) seem to be the primary fountains of the matter, but to have been occasioned by its acrimony.

"This purulent appearance seems to arise merely from an extravasation of one of the component parts of the blood, the gluten or coagulable lymph. Blood taken from persons in a fever, and frequently even from persons in perfect health, after standing in a clean vessel for a short time, commonly separates into three distinct portions; *viz.* the serum, or water of the blood, the red concreted mass, and a viscid pellicle termed the *size*, which spreads itself on the top of the red concretion. Some time ago, when making experiments with the blood taken from persons in the scurvy, I was surprised to find it often covered with that sizy crust. This induced me to extend my experiments to large quantities of blood from different subjects, which I had opportunities of inspecting at once in so large an hospital. For this purpose I one morning ordered ten patients in the scurvy to be bled, taking two ounces from each. A larger quantity was taken, for its inspection, from two men in health. That day I had occasion to prescribe bleeding to a woman in labour, two hours before her delivery; to a girl of sixteen years of age afflicted with a lunacy proceeding from the chlorosis; to three patients in the rheumatism; and to a person labouring under an obstruction of the liver.

"From

(B) In others who died in this yellow state, the bile in the gall-bladder was found of a thick ropy consistence like pitch, but the liver never appeared in the least affected. Dr Lind at first in several bodies opened the head only; but afterwards judged that all the cavities ought to be inspected.

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"From a nice comparison, and an examination of the different blood, I found in general, that the more size there was on the top, and the thicker and more viscid this white pellicle showed itself, the concretion below it was of a more loose coherence. This was not so observable when only some slight white streaks appeared on the top. But when much size had separated itself, the red mass became very soft at the bottom of the vessel, and less compact in its different parts, in proportion to their distance from the surface, towards which this whitish portion had ascended.

"From this and from other experiments it appears, that this crust or pellicle is the natural gluten or cement of the blood (called by some the *coagulable lymph*), which becomes strongly disposed, in certain circumstances and diseases, to separate itself. And whereas the serum and red concretion are easily incorporated together, it will be found, that this glue, after its separation, becomes immiscible with either. We have, by gentle drying, converted it into a perfectly tough elastic membrane; and, by the means of a small portion of the red mass being left adhering to it, into a substance resembling muscular flesh; and it is capable of undergoing various changes into corruption, in the same manner as either of these.

"Now I can see no reason why this gluten, in its morbid state, may not separate itself from the circulating blood, and be deposited in the cavities of the body, as readily as the serum does in dropsies; the former having always a less disposition than the latter to incorporate with the mass.

"In dissecting persons who died of fevers in London and Minorca, and where no infection was suspected, appearances similar to these have also fallen under the inspection of those accurate anatomists Drs Hunter and Cleghorn. Hence it may be presumed very difficult to distinguish fevers that are produced by infection, from some others. I cannot, however, be induced to think, as those gentlemen seem to do, that these preternatural substances which were found in the cavities of the body are the consequence, but rather that they are the cause of the inflammation and excoriations. I believe these substances to be at first diseased extravasated gluten, and conjecture their different states greatly to depend upon the different times at which they were deposited.

"I have remarked in a variety of dead bodies, three different kinds of extravasation; these occurred in such as had died of the scurvy, of the consumption, and of fevers. In the former of those diseases, red coagulated blood is found extravasated in almost all parts of the body, not only into the tela cellulosa, but into the bellies of the muscles, particularly of the legs and thighs, which often become quite stuffed and even distended with large grumous masses. The intestines and mesentery are often spotted also with extravasated blood; and I have seen large ecchymoses on the stomach. These appearances at first sight resembled so many distinct mortifications; and by this appearance some anatomists have been deceived; but, upon a nice examination, the texture, of the parts is found to be sound and firm. There is likewise, in that disease, sometimes, an extravasation of water, chiefly collected in, and always when in the legs confined to, the tela cellulosa.

"But whereas, in the limbs of scorbutic persons, it is extremely difficult to make a good dissection by reason of such quantities of extravasated blood that every where obstruct the operator; so, on the contrary, the lower extremities of those who have died consumptive, with swelled legs, are of all other subjects, in the best state to afford a satisfactory view of the muscles. The water inclosed in their legs having insinuated itself, by passing the tela cellulosa, into the spaces between the muscles, the muscles are easily separated from each other; and their several origins and insertions may be distinctly traced by means of their having been cleansed and washed by the water in the investing cellular membrane. Thus there are extravasations of three sorts; *viz.* first, the grumous mass in the scurvy; and this I have often remarked where no serum was observed. Secondly, the serum alone in anasarcous swellings. The third and last is what was taken notice of in those who died of fevers, being the gluten of the blood, accompanied for the most part with some serum; both of them altogether confined in the large cavities of the body.

"I conjecture, that in those fevers there is always an ulcerous or purulent disposition in the blood; and that this gluten or coagulable lymph is greatly diseased. I have frequently seen it have a true purulent appearance soon after it was drawn off, when the patient seemed not very ill.

"And I further conjecture, that the mischief often lies within the breast; as also that the great benefit derived from the very early application of blisters, in a great measure flows from so many ulcerations and vents being timely provided for the free discharge of those purulent and tainted particles from the body.

"If an infection depends, as many have imagined, on the admission of certain foreign particles into the blood, this gluten seems to be its more immediate seat, and to be primarily affected by it; and a discharge of this, as though by washing those particles out of the body, tends in a great measure to remove the disease.

"It is an observation of the best practical writers, that issues and setons are most excellent preservatives against receiving an infection, nay, even that of the plague itself. And indeed a suppuration and plentiful discharge from a proper ulcer, whether produced by nature or by art, seems to open a channel the best appropriated for an exit out of the body to some of the most malignant poisons. Thus the most favourable crisis in the plague, and in most pestilential fevers, happens when nature excites tumors kindly suppurating in the groin or arm-pits, by whose beneficial and plentiful discharge the deadly poison is expelled from the constitution.

"I have observed it to be amongst the most certain characteristics of the worst fevers, that the blisters either do not rise and fill, or discharge such yellow, greenish, fetid, and highly offensive stuff, that even experienced nurses could give a pretty certain conjecture from the blisters, of the different degrees of malignity in the fever. We have more than once endeavoured to conceal the bad state of some patients in the hospital; but a discovery was always made of their condition in the wash-house, from the linen sent there stained with the discharges from the blistered parts.

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And

Febres. And indeed a careful inspection of the state and discharge from the blisters, together with their effects furnishes us, in those diseases, with some of the most certain diagnostics of their nature and prognostics of their event."

Prognosis. This distemper, where it attacks with violence, is generally fatal; the prognosis therefore must be commonly unfavourable, and always uncertain; neither can any thing more be said on this subject, than that an abatement of the symptoms already enumerated affords a favourable prognostic, and an increase of them the contrary.

Cure. The cure of this terrible disease, according to Dr Hillary, is very easy and simple. His indications are, 1. To moderate the too great and rapid motion of the fluids, and abate the too great heat and violence of the fever in the two first days of the disease, as much and as safely as we can. 2. To evacuate and carry out of the body as much of the putrid bile and other humours, and as expeditiously and safely as possible. 3. To put a stop to the putrescent disposition of the fluids, and to prevent the gangrenes from coming on, by suitable antiseptics.

The first indication is answered by bleeding, which, in the first stage of this fever, is absolutely necessary in some degree: the quantity to be taken away must be determined by the age and strength of the patients, the degree of plethora, fullness of the pulse, &c. When called in at the beginning, he orders 12, 14, 16, 18, or 20 ounces of blood to be taken away on the first or second day: and if the patient's pulse rise after the first bleeding, or if the fever still continue high and the pulse full, he repeats the bleeding once on the days above mentioned. But bleeding a third time is seldom or never required; neither is bleeding on the third day almost ever necessary; and when it is performed on that day, it ought to be done with the greatest caution and judgment; neither should a vein be opened after the third day in this fever, unless some very extraordinary symptoms and circumstances require it; which seldom or never happen. On that day, indeed, the pulse generally sinks, and the blood is in such a dissolved state, that bleeding must be accounted highly pernicious. Nevertheless, it is indispensably necessary in the beginning of the distemper; and if omitted at that time, the violent heat and motion of the blood increase the putrescence of the humours to such a degree as to bring on the fatal consequences much sooner than would otherwise have happened.

After bleeding, we come to the second indication of cure, namely, to evacuate as much of the bilious and putrid humours as soon and as safely as we can. The great irritation of the stomach, by the putrid bilious humours constantly attending this fever, with almost continual retchings and violent vomitings, seem to indicate the giving of an emetic: but the stomach is always observed to be so violently stimulated and irritated and most commonly inflamed by the acrimony of the putrescent bile, that any emetic, even the most mild and gentle, given in the smallest dose, brings on an incessant vomiting, which continues, in spite of all remedies, till a mortification and death ensue. Instead of this, it is proper to give large draughts of warm water, which, without any additional stimulus to the coats of the stomach, evacuates its acrid and putrid contents, commonly with great relief to the patient: the warm water also acts as an emollient fotus to the inflamed coats of the stomach; and thus abates the inflammation, and prevents the gangrene and mortification from coming on. Typhus.

After the patient has by this means vomited seven or eight times or oftener, and discharged a great quantity of yellow and blackish bilious matter as they often do, a grain or a grain and a half of thebaic extract is given in order to procure some respite from the violent retching, vomiting, and anxiety. The person is desired to take nothing into his stomach for two hours after this, by which means it is seldom or never rejected; and thus all the symptoms are considerably abated, the retching and vomiting either totally cease or are very much lessened, so that medicines may now be exhibited which the stomach would not have retained before. These are cooling acid juleps, or other antiseptic remedies; but neither nitre nor any of its preparations will commonly be found to stay on the stomach; nor are the nitrous medicines, or even the common anti-emetic draughts, proper to be given in this disease, even though they should agree with the stomach, on account of their attenuating property.

If the patient has not a stool or two after drinking the warm water and vomiting, it is necessary to give a gentle purging clyster: and when six or eight hours rest have been obtained, a gentle antiphlogistic and antiseptic purge, in order to evacuate by stool as much of the bilious matter as we possibly can. Or if the patient has a purging before, which sometimes though very rarely happens, a dose of toasted rhubarb is given and an antiseptic anodyne after it has operated, to abate and check the too great purging, but not to stop it, as this evacuation has been always observed to be of service, provided it be not too violent.

After this indication is completely answered, the next is to exhibit such proper antiseptic medicines as may stop the putrescent disposition of the fluids. Here the Peruvian bark would seem to be the most proper remedy, but unluckily the stomachs of the patients in this disease are so much irritated, and so apt to reject every thing, that the bark cannot be retained in any form whatever. In this case Dr Percival recommends columbo-root, the infusion of which is found to be a powerful antiemetic and antiputrescent medicine, and might perhaps so far alter the state of the stomach as to make it bear the bark. Dr Hillary, however, who was ignorant of the virtues of columbo, substituted the *radix serpentariæ Virginianæ* with success. A slight infusion of this root not only sat easily on the stomach of the patients, but moderately raised the pulse and fever, both of which are now too low. The following receipt was found the most agreeable and efficacious.

℞ Rad. serpent. Virginian. ʒii.
Croc. Ang. ʒss. M. et infunde vase clauso in aq bul. q. per horam unam ut col. ℥vi. Adde aq. menth. simp. ʒii. Vin. Maderiens. ℥iv. Syr. croc. vel syr. e mecon. ℥i. Elix. vitriol. acid. q. s. ad grat. acidior. sapor. Exhibe cochlearia duo vel tria singulis horis vel bihoris, vel saepius pro re nata.

By the use of this medicine, and soft light nourishment taken in small quantities, the pulse is usually kept up

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up and the distemper goes off. But if, after taking this a little while, we find that the pulse does not rise, but on the contrary that a coldness of the extreme parts comes on, the medicines must be made more warming, by increasing the quantity of the snake-root and saffron, or by adding *vinum croceum*, *confectio cardiaca*, or the like, but not by the use of volatile spirits and salts, which hurt by their stimulating and dissolving qualities. Blisters our author reprobates in the strongest terms, and affirms that he has seen the place where a blister was applied turned perfectly black and sphacelated; so that if the spine and end of the ribs had not hindered, a large square passage would have been opened into the cavity of the thorax, had the patient lived a few hours after it.

At the same time that the strength of the patient is kept up by the medicines abovementioned, or by others similar, he gave repeated gentle purgatives every second or third day, and sometimes, when the symptoms were very urgent, every day, for four or five days successively. But if proper methods be taken in the beginning of the disease, it is seldom that such a repetition of purging is necessary; and the Doctor gives the following remarkable instance of the efficacy of this method of treating the disease: "A young man about 24 years of age, surgeon to a Guinea ship, was brought into a house where I was visiting a patient; he was of a sanguine robust constitution, and a lover of spirituous liquors, and had been drunk three days and nights successively, and in that condition had run several races on the hot sea-shore, near noon, with the sailors, in the heat of the sun; and to complete his folly, lay the last night, after that exercise, in the open air under a tamarind-tree all the night, where he was seized in the morning with all the symptoms of this fever, in the most violent manner that I have ever seen any one. In this condition he was brought to the house where I was: his retching and vomiting were so incessant, that he could not get time to say yes, or no, to the questions which I asked, without waiting some time for it, each time; his eyes were red and inflamed, attended with a burning heat, as usual in the beginning of this fever; and he had all the other symptoms which attend the first attack of this fever in the most violent manner, which I need not repeat. I ordered ℥xvi. of blood to be taken from him, which was very florid, thin, and much dissolved; and then directed him to drink warm water freely, and to vomit eight or ten times; and after that to take *extract Thebaic.* gr. jss. and take nothing for two hours after it. But I being gone, and he finding that he vomited with more ease, less sickness and retching, with the warm water, than he did before, and being much alarmed at his having this fever, he drank three gallons of the water, and brought up great quantities of yellow and blackish bilious matter with it, and washed his stomach effectually. He then took the *extr. thebaic.* and slept three or four hours after it; and the vomiting ceased: he took some panada, and four hours after that the purge of manna and tamarinds, &c. which gave him eight stools, and carried a good deal more of the putrid bilious matter off downwards; and got some rest after it: he then took of an antiseptic julep often, and light nourishment, a little acid, at the intervals; and repeated the purge on the third day, as directed. Being called out of the town, I did not see him till the fourth morning after; he said that he had followed my directions; and I found him free from the fever and all its symptoms, but weak and low, and his skin a little yellow, but much less so than usual, unless when the bilious matter is thus carried off. I ordered him to take *elix. vitrioli acid. gut.* lx. three or four times a-day for a few days, in an infusion of mint-leaves with a little snake-root, made as tea; which he did, and soon recovered perfectly well in seven or eight days time.

Typhus.

"This patient being seized in so violent a manner, and recovering in so short a time, and so near to the rule which the elegant Celsus recommends *citò, tutò, et jucundè*, not only confirmed the above manner of reasoning on the cause and nature of this disease to be right, but made me determine to follow the same method as near as I possibly could ever since, and I must add, with the same good success also, when I am called so early in the disease that I can strictly pursue it: which is too seldom the case; for in general the physician is not called till the fourth or fifth day, or after, when the putrid acrid bilious matter is a great part of it carried into the blood, which it has so dissolved and brought its whole mass into a colliquated, putrid, gangrenescent state, that the best of methods, and the most efficacious medicines, however judiciously timed and applied, are precarious and uncertain; or sometimes it is so far advanced, that the ablest physician can do no more than tell the relations of the sick that it is too late, and that they can live but a few hours: for I know no disease in which the recovery of the patient so much depends upon the right or wrong method of treating it, at the very first attack or beginning of the disease, as this fever does: for by thus discharging and carrying the putrid, acrimonious, bilious matter, out of the body before much of it is carried into the blood, not only most of the bad symptoms which attend the second state of the fever are prevented from coming on, but the hæmorrhagies, and the yellowness of the skin, &c. also, and the fever soon taken off too; for I have never seen any hæmorrhagy come on, and but little yellowness, or in some none, when they were thus treated.

"And when the last stage of this fever is come on before we are called in, provided that it is not at the very latter end of it, I have always found that this method of gentle purging, whenever the beforementioned symptoms indicate it, and a liberal use of the antiseptic medicines in the intervals, has been so successful, that I have seen but two patients that have died in this fever during the eight years past in which I treated it in this manner; and one of them was so weak that he could not take a spoonful of any thing, and so near his end that he died about two hours after without taking any medicine; and the other killed himself by drinking a gallon of cold water in less than three hours time (after taking half an ounce of manna in the morning), which struck such a coldness into his whole body that he died: though I have visited several every year, and in some years a great many: therefore I take the liberty of recommending this method to others, and wish it to be as successful to all."

To the genus of *typhus* also belong all those fevers attended with very profuse and debilitating sweats, and which

Febres. which have ſometimes, not without good reaſon, been accounted plagues; ſuch as the Engliſh ſweating ſickneſs, Miliaris ſudatoria, *Sauv.* ſp. 5. Ephemera ſudatoria, *Sauv.* ſp. 7. Ephemera Britannica, *Caius de ephem. Britann.*

169 GENUS VI. SYNOCHUS.

Synochus *Sauv.* gen. 81. *Lin.* 13.
Lenta *Lin.* 14.
Phrenitis *Vog.* 18.

Febris continua putrida *Boerh.* 730.

THIS is a contagious diſtemper, being a complication of a Synocha and Typhus; for the diſcription and cure of which, we muſt of conſequence refer to what hath been already ſaid concerning theſe diſeaſes.

The *Hectic* FEVER.

170 Hectica, *Sauv.* gen. 83. *Lin.* 24. *Vog.* 80. *Sag.* 684.

THIS diſeaſe is reckoned by Dr Cullen to be merely ſymptomatic; as indeed ſeems very probable, ſince it very generally accompanies abſorptions of pus into the blood from internal ſuppurations, or indeed from ſuch as are external, provided they be very large or of a bad kind.

Deſcription. The beſt, indeed the only proper, deſcription of this diſorder we have is that by Dr Heberden. According to him, the appearance of the hectic fever is not unlike that of the genuine intermittent; from which, however, the diſeaſe is very different in its nature, while at the ſame time it is much more dangerous. In the true intermittent, the three ſtages of cold, heat, and ſweat, are far more diſtinctly marked, the whole fit is much longer, the period which it obſerves is more conſtant and regular, and the intermiſſions are more perfect, than in the hectic fever. For in the latter, even in the cleareſt remiſſion, there is uſually a feveriſh quickneſs perceptible in the pulſe, which ſeldom fails to exceed the utmoſt limit of a healthy one by at leaſt 10 ſtrokes in minute.

The chillneſs of the hectic fever is ſometimes ſucceeded by heat, and ſometimes immediately by a ſweat without any intermediate ſtate of heat. The heat will ſometimes come on without any remarkable chillneſs preceding; and the chillneſs has been obſerved to go off without being followed either by heat or ſweat. The duration of theſe ſtages is ſeldom the ſame for three fits together; and as it is not uncommon for one of them to be wanting, the length of the whole fit muſt vary much more than in the true intermittent: but in general it is much much ſhorter.

A patient ſubjected to hectic fever is little or nothing relieved by the coming on of the ſweat; but is often as anxious and reſtleſs under it as during the chillneſs or heat. When the ſweat is over, the fever will ſometimes continue; and in the middle of the fever the chillneſs will return; which is a moſt certain mark of this diſeaſe.

The hectic fever will return with great exactneſs, like an intermittent, for two or perhaps three fits; but Dr Heberden informs us, that he does not remember ever to have known it to keep the ſame period for four fits ſucceſſively. The paroxyſm will now and then keep off for 10 or 12 days; and at other times, eſpecially when the patient is very ill, it will return ſo frequently on the ſame day, that the chillneſs of a new fit will follow immediately the ſweat of the former. It is not unuſual to have many threatenings of a ſhivering in the ſame day; and ſome degree of drowſineſs is apt to attend the ceſſation of a fit. Hectica.

The urine in a true intermittent is clear in the fits and turbid in the intervals; but in the hectic fever it is liable to all kinds of irregularity. It will be equally clear or turbid in both ſtages; or turbid in the fits and clear in the intervals; and ſometimes it will be, as in a true intermittent, clear during the fever, and thick at the going off.

Hectic patients often complain of pains like thoſe of the rheumatiſm, which either affect by turns almoſt every part of the body, or elſe return conſtantly to the ſame part; which is often at a great diſtance from the ſeat of the principal diſorder, and, as far as is known, without any peculiar connection with it. Thoſe pains are ſo violent in ſome patients, as to require a large quantity of opium. As far as Dr Heberden has obſerved, they are moſt common, where the hectic ariſes from ſome ulcer open to the external air, as in cancers of the face, breaſt, &c. Joined with this fever, and ariſing probably from one common cauſe, he has been ſurpriſed to ſee ſwellings of the limbs, neck, or trunk of the body, riſe up almoſt in an inſtant, as if the part was all at once grown fatter. Theſe ſwellings are not painful, hard, or diſcoloured, and they continue for ſeveral hours.

Dr Heberden has ſeen this fever attack thoſe who ſeemed in tolerable health, in a ſudden and violent manner, like a common inflammatory one; and like that, alſo, in a very ſhort time bring them into imminent danger of their lives; after which it has begun to abate, and to afford hopes of a perfect recovery. But though the danger might be over for the preſent, and but little of a fever remain; yet that little has ſoon demonſtrated, that it was kept up by ſome great miſchief within, and, proving unconquerable by any remedies, has gradually undermined the health of the patient, and never ceaſed except with his life. This manner of its beginning, however, is extraordinary. It much oftener diſſembles its ſtrength at firſt; and creeps on ſo ſlowly, that the ſubjects of it, though they be not perfectly well, yet for ſome months hardly think themſelves ill; complaining only of being ſooner tired with exerciſe than uſual, of want of appetite, and of falling away. But gentle as the ſymptoms may ſeem, if the pulſe be quicker than ordinary, ſo as to have the artery to beat 90 times and perhaps 120 times in a minute, there is the greateſt reaſon to be apprehenſive of the event. In no diſorder, perhaps, is the pulſe of more uſe to guide our judgment than in the hectic fever: yet even here we muſt be upon our guard, and not truſt entirely to this criterion; for one in about twenty patients, with all the worſt ſigns of decay from ſome incurable cauſe, which irreſiſtibly goes on to deſtroy his life, will ſhow not the ſmalleſt degree of quickneſs, nor any other irregularity of the pulſe, to to the day of his death.

Cauſes, &c. This fever will ſupervene whenever there is a great collection of matter formed in any part of the body; but it more particularly attends upon the

Febres. inflammation of a scirrhous gland, and even upon one that is slight and only just beginning; the fever growing worse in proportion as the gland becomes more inflamed, ulcered, or gangrenous. And such is the lingering nature of those glandular disorders, that the first of those stages will continue for many months, and the second for some years.

If this scirrhous inflammation be external, or in the lungs, or some of the abdominal viscera, where the disturbance of their functions plainly points out the seat of the disorder, no doubt can be entertained concerning the cause of the fever. But if the part affected be not obvious to the senses, and its precise functions be not known, the hectic, which is there only part of the train of another disease, may be mistaken for the primary or only one.

Lying-in women, on account of the violence sustained in delivery, generally die when affected with this fever. Women of the age of near 50 and upwards are particularly liable to it. For, upon the cessation of their natural discharge, the glands of the breasts, ovaries, or womb, too commonly begin to grow scirrhous, and proceed to be cancerous. Not only these, but the glandular parts of all the abdominal viscera, are disposed to be affected at this particular time, and to become the seats of incurable disorders.

The injuries done to the stomach and liver by hard drinking are attended with similar symptoms, and terminate in the same manner.

Dr Heberden observes, that the slightest wound by a fine pointed instrument is known upon some occasions to bring on the greatest disturbances, and the most alarming symptoms, nay even death itself. For not only the wounded part will swell and be painful, but by turns almost every part of the body; and very distant parts have been known to come even to suppuration. These symptoms are constantly accompanied with this irregular intermittent, which lasts as long as any of them remain.

Prognosis. This anomalous fever is never less dangerous than when it belongs to a kindly suppuration, into which all the diseased parts are melted down, and for which there is a proper outlet.

The symptoms and danger from some small punctures, with their concomitant fever, most frequently give way in a few days; though in some persons they have continued for two or three months, and in others have proved fatal.

The inflammation of internal scirrhous glands, or of those in the breasts, sometimes goes off, and the fever, which depended upon it, ceases; but it much oftener happens, that it proceeds to cancerous and gangrenous ulcers, and terminates only in death. Death is also, almost universally, the consequence of hectic fever from tubercles of the lungs, which have in general at least been considered as glandular bodies in a scirrhous state.

Cure. It is not to be expected that the same remedies will in every case be adapted to a fever which, arising from very different causes, is attended with such a variety of symptoms. A mixture of asafetida and opium has in some persons seemed singularly serviceable in this fever, when brought on by a small wound; but in most other cases the principal if not the sole attention of the physician must be employed in relieving the symptoms, by tempering the heat, by preventing both costiveness and purging, by procuring sleep, and by checking the sweats. If, at the same time, continues Dr Heberden, he put the body into as good general health as may be, by air, exercise, and a proper course of mild diet, he can perhaps do nothing better than to leave all the rest to nature. In some few fortunate patients, nature appears to have such resources, as may afford reason for entertaining hopes of cure, even in very bad cases. For some have recovered from this fever attended with every symptom of an abdominal viscus incurably diseased, after all probable methods of relief from art had been tried in vain, and after the flesh and strength were so exhausted as to leave scarce any hopes from nature. In those deplorable circumstances, there has arisen a swelling not far from the probable seat of the disorder, and yet without any discoverable communication with it. This swelling has come to an abcess; in consequence of which the pulse has soon returned to its natural state, as have also the appetite, flesh and strength. What nature has performed in those rare cases, Dr Heberden acquaints us, he has often endeavoured to imitate, by making issues or applying blisters near the seat of the disease; but he cannot say with the same success.

Hectics.

It seems at present, Dr Heberden observes, the opinion of many practitioners, that the gangrenes will be stopped, and suppuration become more kindly, by the use of Peruvian bark; and therefore this remedy is always either advised or permitted in the irregular fever joined with suppurations and gangrenes. But he affirms he does not remember ever to have seen any good effect from the bark in this fever unattended with an apparent ulcer; and even in gangrenes it so often fails, that in successful cases, where it has been administered, there must be room for suspicion that that the success was owing to another cause. Dr Heberden acknowledges at the same time, that he never saw any harm from the bark, in these, or indeed in any other cases, except a slight temporary purging or sickness, where it has happened to disagree with the stomach, or where the latter has been loaded by taking the medicine too fast, especially in dry boluses wrapped in wafer-paper.

In hectic illnesses, where all other means have proved ineffectual, a journey to bath is usually proposed by the friends, and wished for by the sick; but Dr Heberden justly observes, that, besides the fatigue and many inconveniences of a journey to a dying person, the Bath waters are peculiarly hurtful in this fever, which they never fail to increase, and thereby aggravate the sufferings and hasten the death of the patient.

ORDER II. PHLEGMASIÆ. 171

Phlegmasiæ membranosæ et parenchymatosæ, *Sauv.* Class III. Ord. I. II. *Sag.* 605.
Morbi febriles phlogistici, *Lin.* Class III.
Febres continuæ compositæ inflammatoriæ, V.
Morbi acuti febriles, *Boerh.* 770.
Febres inflammatoriæ, *Hoffm.* II. 105. *Junck.* 61.

The phlegmasiæ, or topical inflammations, are a very numerous assemblage of diseases. Their great char-

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characteristics are, the general symptoms of fever, and a topical inflammation, attended with the lesion of some important function. And in most instances, when blood is drawn, it is found upon coagulation to be covered with a buffy coat. Under this order, many important genera are comprehended, each requiring a separate consideration.

172 GENUS VII. PHLOGOSIS.

173 Sp. I. PHLOGOSIS PHLEGMONE.

Phlegmone auctorum, *Sauv.* gen. 15. *Lin.* 39. *Vog.* 351.

Inflammatio, *Lin.* 231. *Boerh.* 370. *Junck.* 20.

This disease is a synocha fever, accompanied with an inflammation of some particular part either external or internal, and consequently it varies very much in its form and the degree of danger attending it, according to the situation and functions of the part affected with topical inflammation. To this species, therefore, belong the following diseases.

Furunculus, *Sauv.* gen. 18. *Vog.* 352.
Terminthus, *Vog.* 381.
Pupula, *Lin.* 275. *Sauv.* p. 6.
Varus, *Vog.* 436. *Lin.* 269. *Sauv.* p. 7.
Bacchia, *Lin.* 270.
Gutta Rosea, *Sauv.* gen. 4.
Gutta rosacea, *Vog.* 437.
Hordeolum, *Sauv.* gen, 27. *Lin.* 276. *Vog.* 434
Otalgia, *Sauv.* gen. 197. *Lin.* 44. *Vog.* 148.
Dolor otalgicus, *Hoffm.* II. 336.
Parulis, *Vog.* 362.
Mastodynia, *Sauv.* gen. 210. *Vog.* 153.
Paronychia, *Sauv.* gen. 21. *Lin.* 258. *Vog.* 345.
Arthrocace, *Sauv.* gen. 78. *Lin.* 256.
Paedarthrocace. *Vog.* 419.
Spina ventosa, *Boerh.* 526.
Phimosis, *Sauv.* gen. 22. *Lin.* 297, *Vog.* 348.
paraphimosis, *Vog.* 349.

For the cure of inflammations, Dr Cullen lays down the following indications. 1. To remove the remote causes when they are evident and continue to operate. 2. To take off the phlogistic diathesis affecting the whole system, or the particular part. 3. To take off the spasm of the particular part by remedies applied to the whole system or to the part itself.

The means of removing the remote causes will readily occur, from considering the particular nature and circumstances of the different kinds. Acrid matters must be removed, or their action must be prevented, by the application of demulcents, Compressing and overstretching powers must be taken away; and from their several circumstances, the means of doing so will be obvious.

The means of taking off the phlogistic diathesis of the system are the same with those already mentioned under the cure for synocha. The means of taking off the spasm also from the particular part, are much the same with those already mentioned. Only it is to be remembered, that topical bleedings, such as cupping with scarifications, applying leeches, &c. are in this case much more indicated; and that some of the other remedies are to be directed more particularly to the part affected, as shall be more fully considered when we treat of those diseases attended with particular inflammations.

Phlogosis.

When a tendency to suppuration is perceived, the proper indication is to promote the production of perfect pus as much as possible. For this purpose various remedies, supposed to possess a specific power, have been proposed: but it does not appear that any of them are possessed of a virtue of this kind; and, in Dr Cullen's opinion, all that can be done is to favour the suppuration by such applications as may support a moderate heat in the part, by some tenacity confine the perspiration, and by an emollient quality may weaken the cohesion of the teguments, and favour their erosion As all abscesses are occasioned by the effusion of fluids and as in the case of certain effusions a suppuration becomes not only unavoidable but desirable, it may be supposed that most of the means of procuring a resolution by diminishing the force of circulation, &c. ought to be avoided, but as we observe on the one hand, that a certain degree of increased impetus, or of the original symptoms of inflammation, is necessary to produce a proper suppuration; so it is then especially necessary to avoid those means of resolution which may diminish too much the force of circulation. And on the other hand, as the impetus of the blood, when violent, is found to prevent the proper suppuration; so, in such cases, though a tendency to suppuration may have begun, it may be proper to continue those means of resolution which moderate the force of the circulation, With respect to the opening of abscesses when completely formed, see the article SURGERY.

When an inflammation has taken a tendency to gangrene, that event is to be prevented by every possible means; and these must be different according to the nature of the several causes: but after a gangrene has in some degree taken place, it can be cured only by the separation of the dead from the living parts. This in certain circumstances can be performed, and most properly, by the knife. In other cases it can be done by exciting a suppuratory inflammation on the verge of the living part, whereby its cohesion with the dead part may be every where broken off, so that the latter may fall off by itself. While this is doing, it is proper to prevent the further putrefaction of the part, and its spreading wider. For this purpose various antiseptic applications have been proposed: but Dr Cullen is of opinion, that while the teguments are entire, these applications can hardly have any effect; and therefore, that the fundamental procedure must be to scarify the part so as to reach the living substance, and, by the wounds made there, to excite the suppuration required. By the same incisions also we give access to antiseptics, which may both prevent the progress of the putrefaction in the dead, and excite the inflammation necessary on the verge of the living parts.

When the gangrene proceeds from the loss of tone, and when this communicated to the neighbouring parts prevents that inflammation which, as we have said, is requisite to the separation of the dead parts from the living, it will be necessary to obviate this loss of tone by tonic medicines given internally; and for this purpose the Peruvian bark has been found to be most effectual. But when the gangrene arises from the violence of inflammation, the bark may not only fail of proving a remedy, but may do harm: for its power as a tonic is especially suited to those cases of gangrene which proceed from an original loss of tone, as in the case

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case of palsy and œdema; or in those cases where a loss of tone takes place while the original inflammatory symptoms are removed.

On the other hand, Mr Bell is of opinion, that incisions made with a view to admit the operation of antiseptic remedies in gangrenes, as well as the remedies themselves, must be pernicious from the irritation they occasion, and from the danger of wounding blood-vessels, nerves, or tendons, and also by allowing a free passage for the putrescent fluids into the parts not yet affected. And unless they be carried so deep as to reach the sound parts, applications of the antiseptic kind can never have any effect in answering the purpose for which they were intended. The same author also remarks, that all the advantages commonly observed from the great number of applications recommended for gangrene, are obtained with more ease, and generally too with more certainty, from the use of some gentle stimulating embrocation; which, by exciting a slight irritation upon the surface, especially when assisted by a free use of the Peruvian bark, produces for the most part such a degree of inflammation as is wished for. With this view he has frequently known a weak solution of sal ammoniac, a drachm of the salt to two ounces of vinegar and six of water, form a mixture of very proper strength for every purpose of this kind. But the degree of stimulus can either be easily increased or diminished according to circumstances, by using a larger or smaller proportion of the salt.

Whenever, either by the means recommended, or by a natural exertion of the system, a slight inflammation appears between the diseased and sound parts, we may in general, with tolerable certainty, expect, that in due time the parts will be separated; and when a full suppuration is once fairly established, there can be little doubt that the mortified parts will be soon and easily removed.

A complete separation being effected, the remaining sore is to be treated in the manner described under the article SURGERY; with a proper attention, at the same time, to the support of the general system by the continuance of a nourishing diet, and the bark with such quantities of wine as may seem necessary.

With regard to the bark, however, it is proper to take notice of another case of mortification in which it is likewise unsuccessful, as well as in that attended with an high degree of inflammation; and that is, in those mortifications of the toes and feet, common in old people, or which arise from any cause increasing the rigidity of the vessels to such a degree as to prevent the motion of the fluids through them. In this case Mr Pott has discovered, that all kinds of warm applications are very unsuccessful; but that by the free use of opium, together with sedatives and relaxants externally applied, he has frequently seen the tumefaction of the feet and ancles subside, the skin recover its natural colour, and all the mortified parts separate in a very short time, leaving a clean sore. But as to scarifications, or any other attempt to separate artificially the mortified from the sound parts, he thinks them very prejudicial, by giving pain; which is generally of itself violent in this disease, and which seems to have a great share in producing the other evils.

The other terminations of inflammation either do not admit of any treatment except that of preventing them by resolution, or properly belong to the article SURGERY.

Phlogosis.

Sp. II. PHLOGOSIS ERYTHEMA.

Erythema, *Sauv.* gen. 11.
  Erysipelas auctorum, *Vog.* 343.
  Hieropyr. *Vog.* 344.
Anthrax, *Sauv.* gen. 19. *Lin.* 272. *Vog.* 353.
  Carbo et carbunculus auctorum.
  Erythema gangrænosum, *Sauv.* sp. 7.
Erythema a frigore.
  Erythema pernio, *Sauv.* sp. 4
  Pernio, *Lin.* 259. *Vog.* 350.
Erythema ambustio, *Sauv.* sp. 2.
  Erysipelas ambustio, *Sauv.* sp. 4.
  Combustura, *Lin* 245.
  Combustio, *Boerh.* 476.
Encausis, *Vog.* 347.
Erythema ab acri alieno applicato.
  Erysipelas Chinense, *Sauv.* sp. 7.
Erythema ab acri inquilino.
  Erythema intertrigo, *Sauv.* sp. 5.
  Intertrigo, *Lin.* 247. *Vog.* 502.
Erythema a compressione.
  Erythema paratrima, *Sauv.* sp. 6.
Erythema a punctura, *Sauv.* sp. 9.
  Erysipelas a vespis, *Sauv.* sp. 19.
  Psydracia a vespis, *Sauv.* sp. 2.
Erythema cum phlegmone.
  Erysipelas phlegmonodes auctorum.
Erythema cum œdemate.
  Erysipelas symptomaticum, *Sauv.* sp. 6

The word *erythema* doth not apply to any primary disease, but to a great number of those cutaneous inflammations denominated by another general term, *viz.* the *erysipelas*, or "St Anthony's fire;" and which being commonly symptomatic, of some other inflammation or disorder, are to be removed only by removing the primary disease: the erythema is found scarcely to bear any kind of warm application to itself; and is very apt, if treated as a primary disease, to terminate in a gangrene of the part affected, or some other disorder still more dangerous. The difference between the *phlegmon* or preceding species, and *erythema*, according to Dr Cullen, is, that, in the former, the inflammation seems particularly to affect the vessels on the internal surface of the skin, communicating with the lax adjacent cellular texture; whence a more copious effusion, and that too of serum convertible into pus, takes place. In the erythema the affection is of the vessels on the external surface of the skin communicating with the *rete mucosum*, which does not admit of any effusion but what separates the cuticle and gives occasion to the formation of a blister, while the smaller size of the vessels admits only of the effusion of a thin fluid very seldom convertible into pus. For the cure of the fever attended with erythema or *erysipelas*, see below; and for the external treatment of erythema, see the article SURGERY.

GENUS VIII. OPHTHALMIA.

Inflammation of the Eyes. 175

Ophthalmia, *Sauv.* gen. 196. *Lin.* 43. *Vog.* 341.
  Sag. 231. *Junck.* 24.
Chemosis, *Vog.* 46.

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Ophthalmites, *Vog.* 47.
Inflammatio oculorum, *Hoffm.* II. 165.
Ophthalmia taraxis, *Sauv.* sp. 1.
Ophthalmia humida, *Sauv.* sp. 8.
Ophthalmia chemosis, *Sauv.* sp. 12.
Ophthalmia erysipelatosa, *Sauv.* sp. 7.
Ophthalmia pustulosa, *Sauv.* sp. 6.
Ophthalmia phlyctænodes, *Sauv.* sp. 21.
Ophthalmia choroeidea, *Sauv.* sp. 13.
Ophthalmia tenebricosa, *Sauv.* sp. 10.
Ophthalmia trachoma, *Sauv.* sp. 4.
Ophthalmia sicca, *Sauv.* sp. 5.
Ophthalmia angularis, *Sauv.* sp. 14.
Ophthalmia tuberculosa, *Sauv.* sp. 3.
Ophthalmia trichiasis, *Sauv.* sp. 2.
Ophthalmia cancrosa, *Sauv.* sp. 15.
Ophthalmia asynechia, *Sauv.* sp. 16.
Ophthalmia alagophthalmo, *Sauv.* sp. 17.
Ophthalmia ab elcomate, *Sauv.* sp. 18.
Ophthalmia ab ungue, *Sauv.* sp. 19.
Ophthalmia a corneæ fistula, *Sauv.* sp. 20.
Ophthalmia uveæ, *Sauv.* sp. 22.
Ophthalmia metastatica, *Sauv.* sp. 24.
Ophthalmia scrophulosa, *Sauv.* sp. 9.
Ophthalmia syphilitica, *Sauv.* sp. 11.
Ophthalmia febricosa, *Sauv.* sp. 23.

From reading this long list of distinctions which authors have invented in the ophthalmia, it is evident, that by far the greatest part of them are symptomatic, or merely the consequences of other disorders present in the habit; and therefore the remedies must be directed towards the removal of these primary disorders; and when they are gone the ophthalmia will be removed of course. Dr Cullen observes, that the inflammation of the eye may be considered as of two kinds; according as it is seated in the membranes of the ball of the eye, when it is named *ophthalmia membranarum;* or as it is seated in the sebaceous glands placed in the tarsus, or edges of the eye-lids, in which case it may be termed *ophthalmia tarsi.* These two kinds are very frequently connected together, as the one may excite the other; but they are still to be distinguished according as the one or the other may happen to be the primary affection.

1. The inflammation of the *membranes* of the eye affects especially, and most frequently, the adnata, and appears in a turgescence of its vessels; so that the red vessels which are naturally there, become not only increased in size, but many more appear than in a natural state. This turgescence of the vessels is attended with pain, especially from the motion of the ball of the eye; and this irritation, like every other, applied to the surface of the eye, produces an effusion of tears from the lacrymal gland.

The inflammation commonly, and chiefly, affects the adnata spread on the anterior part of the bulb of the eye; but usually spreads also along the continuation of the adnata on the inside of the palpebræ; and as that is extended on the tarsus palpebrarum, the excretories of the sebaceous glands opening there are also frequently affected. When the affection of the adnata is considerable, it may be communicated to the subjacent membranes of the eye, and even to the retina itself; which thereby acquires so great sensibility, that every impression of light becomes painful. The inflammation of the membranes of the eye is in different degrees, according as the adnata is more or less affected, or according as the inflammation is either of the adnata alone, or of the subjacent membranes also; and upon these differences, different species have been established; but they seem all to differ only in degree, and are to be cured by the same remedies more or less employed.

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The proximate cause of ophthalmia is not different from that of inflammation in general; and the different circumstances of ophthalmia may be explained by the difference of its remote causes, and by the different parts of the eye which it happens to affect; as may be understood by what has been already said. We shall therefore proceed to give an account of the method of cure.

The great objects to be aimed at in the treatment of ophthalmia, are, in the first place, the resolution of the inflammation which has already taken place; and, secondly, the removal of those consequences which frequently arise from the inflammation, especially if it have been of long standing. But besides these, while it has appeared from former observation, that there is a peculiar disposition to the disease, practices may often be successfully employed to combat this disposition, and thus prevent the return of the affection.

The ophthalmia membranarum requires the remedies proper for inflammation in general; and when the deeper-seated membranes are affected, and especially when a pyrexia is present, large general bleedings may be necessary. But this last is seldom the case; and, for the most part, the ophthalmia is an affection merely local, accompanied with little or no pyrexia. General bleedings therefore have little effect upon it, and the cure is chiefly to be obtained by topical bleedings, that is, blood drawn from the vessels near the inflamed part; and opening the jugular vein, or the temporal artery, may be considered as in some measure of this kind. It is commonly sufficient to apply a number of leeches round the eye; but it is perhaps still better to draw blood by cupping and scarifying upon the temples. In many cases, the most effectual remedy is to scarify the internal surface of the inferior eye-lid, and to cut the turgid vessels upon the adnata itself.

Besides the blood-letting, purging, as a remedy suited to inflammation in general, has been considered as peculiarly adapted to inflammation in any part of the head, and therefore to ophthalmia; and it is sometimes useful: but, for the reasons given before with respect to general bleeding, purging in the case of ophthalmia does not prove useful in any proportion to the evacuation excited. For relaxing the spasm in the part, and taking off the determination of the fluids to it, blistering near the part has commonly been found useful. When the inflammation does not yield to the application of blisters after topical bleeding, great benefit is often obtained by supporting a discharge from the blistered part, under the form of an issue, by which means a more permanent determination of blood from the part is obtained.

It is probably also on the same principle that the good effects obtained from the use of errhine medicines in obstinate cases of ophthalmia are to be accounted for. By these errhines, in particular, which occasion

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and support for some time a great discharge from the nose, great benefit has often been obtained. The powder of asarabacca, or the infusion of hippocastanum, snuffed up the nose at bed-time in proper doses, are often productive of the best effects, when many other remedies have been tried in vain.

Ophthalmia, as an external inflammation, admits of topical applications. All those, however, which increase the heat and relax the vessels of the part, prove hurtful; and the admission of cool air to the eye, and the application of cooling and astringent medicines which at the same time do not produce irritation, prove useful. Of all these the solution of acetated lead, assiduously applied, is perhaps the best. In the cure of this distemper, indeed, all irritation must carefully be avoided, particularly that of light; and the only certain means of doing this is by keeping the patient in a very dark chamber.

2. In the *ophthalmia tarsi*, the same medicines may be necessary, as have been already recommended, for the ophthalmia membranarum. However, as the ophthalmia tarsi may often depend upon an acrimony deposited in the sebaceous glands of the part, so it may require various internal remedies according to the variety of the acrimony in fault; for which we must refer to the consideration of scrophula, syphilis, or other diseases with which this ophthalmia may be connected; and where these shall not be evident, certain remedies more generally adapted to the evacuation of acrimony, such as mercury, may be employed. In the ophthalmia tarsi, it almost constantly happens that some ulcerations are formed on the tarsus. These require the application of mercury and copper, which alone may sometimes cure the whole affection; and they may be useful even when the disease depends upon a fault of the whole system.

Both in the ophthalmia membranarum, and in the ophthalmia tarsi, it is necessary to obviate that glueing together of the eye-lids which commonly happens in sleep; and which may be done by insinuating a little of any mild unctuous medicine between the eye-lids before the patient shall go to sleep,

The slighter kinds of inflammations from the dust or the sun, may be removed by fomenting with warm milk and water, adding a small portion of brandy; and by anointing the borders of the eye-lids with *unguentum tutiæ*, or the like, at night, especially when those parts are excoriated and sore. But in bad cases after the inflammation has yielded a little to evacuations, the *cataplasma aluminis* of the London pharmacopœia spread on lint, and applied at bed-time, has been found the best external remedy. Before the use of the latter, the solution of white vitriol is prescribed with advantage; and in violent pains it is of service to foment frequently with a decoction of white poppy heads. One of the most common and most disagreeable consequences of ophthalmia, is an offuscation of the cornea, so far obstructing the passage of light as to diminish or prevent vision. This is sometimes so considerable as to admit of removal by operation: but in slighter cases it may often be removed by the application of different gentle escharotics; and in this way, without the least danger of any inconvenience, good effects are often obtained, from gently introducing into the eye at bed-time a powder consisting of equal parts of crystals of tartar and sugar.

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Where there is a disposition to frequent returns of this affection, the Peruvian bark is often employed with success in combating it: But nothing in general answers better than frequent and regular cold bathing of the eyes.

Genus IX. PHRENITIS. 176

Phrenzy, or *Inflammation of the Brain.*

Phrenitis, *Sauv.* gen. 101. *Lin.* 25. *Sag.* gen. 301 *Boerh.* 771. *Hoffm.*II. 131. *Junck.* 63.
Phrenismus, *Vog.* 45.
Cephalitis, *Sauv.* gen. 109. *Sag.* gen. 310.
Sphacelismus,, *Lin.* 32
Phrenitis vera, *Sauv.* sp 1. *Boerh.* 771.
Phrenitis idiopathica, *Junck.* 63.
Cephalalgia inflammatoria, *Sauv.* Sp. 9.
Cephalitis spontanea, *Sauv.* sp. 3.
Cephalitis siriasis, *Sauv.* sp. 4.
Siriasis, *Vog.* 34.
Cephalitis Littriana, *Sauv.* sp. 5.

Dr Cullen observes, that the true phrenitis, or inflammation of the membranes or substance of the brain, is very rare as an original disease: but, as a symptom of others, much more frequent; of which the following kinds are enumerated by different authors.

Phrenitis synochi pleuriticæ, *Sauv.* sp. 2.
Phrenitis synochi sanguineæ, *Sauv.* sp. 4.
Phrenitis calentura, *Sauv.* sp. 11.
Phrenitis Indica, *Sauv.* sp. 12.
Cephalitis Ægyptiaca, *Sauv.* sp. 1.
Cephalitis epidemica anno 1510, *Sauv.* sp. 6.
Cephalitis verminosa, *Sauv.* sp. 7.
Cephalitis cerebelli, *Sauv.* sp. 8.
Phrenitis miliaris, *Sauv.* sp. 3.
Phrenitis variolosa, *Sauv.* sp. 5.
Phrenitis morbillosa, *Sauv.* sp. 6.
Phrenitis a plica, *Sauv.* sp. 8.
Phrenitis aphrodisiaca, *Sauv.* sp. 9.
Phrenitis a tarantismo, *Sauv.* sp. 14.
Phrenitis hydrophobica, *Sauv.* sp. 15.
Phrenitis a dolore, *Sauv.* sp. 13.
Cephalitis traumatica, *Sauv.* sp. 2.

Description. The signs of an impending phrenitis are, immoderate and continual watchings; or if any sleep be obtained, it is disturbed with dreams and gives no refreshment; acute and lasting pains, especially in the hind part of the head and neck; little thirst; a great and slow respiration, as if proceeding from the bottom of the breast, the pulse sometimes small and slow, sometimes quick and frequent; a suppression of urine; and forgetfulness. The distemper when present may be known by the following signs: The veins of the head swell, and the temporal arteries throb much; the eyes are fixed, sparkle, and have a fierce aspect; the speech is incoherent, and the patient behaves very roughly to the by-standers, with furious attempts to get out of bed, not indeed connually, but returning as it were by paroxysms; the tongue is dry, rough, yellow, or black; there is a coldness of the external parts; a proneness to anger; chattering of the teeth; a trembling of the hands, with

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with which the sick seem to be gathering something and actually do gather the naps off the bed-clothes.

Causes of, and persons subject to, this disorder. People of a hot and bilious habit of body, and such as are of a passionate disposition, are apt to be affected with phrenitis. In the same danger are those who use much spices, or are given to hot and spirituous liquors; who have been exposed more than usual to the sun, or obliged to undergo immoderate studies or watchings; who are subject to head-achs, or in whom some customary hemorrhages have been stopped; or the disease may arise from some injury offered to the head externally. Dr Pringle observes, that the phrenitis, when considered as an original disease, is apt to attack soldiers in the summer-season when they are exposed to the heat of the sun, and especially when asleep and in liquor. A symptomatic phrenitis is also more frequent in the army than elsewhere, on account of the violence done to all fevers when the sick are carried in waggons from the camp to an hospital, where the very noise or light alone would be sufficient, with more delicate natures, to raise a phrenzy. From these and similar causes, a state of active inflammation, affecting some parts within the cranium, is produced: and there can be no doubt, that from this all the symptoms of the disease arise, and particularly that peculiar delirium which characterises it. But in what manner local diseases, even of the brain itself, produce affections of the mind, we are still totally in the dark.

Prognosis. Every kind of phrenitis, whether idiopathic or symptomatic, is attended with a high degree of danger; and, unless removed before the fourth day, a gangrene or sphacelus of the meninges readily takes place, and the patient dies delirious. The following are the most fatal symptoms: A continual and furious delirium, with watching; thin watery urine, white fæces, the urine and stools running off involuntarily or a total suppression of these excretions; a ready disposition to become stupid, or to faint; trembling, rigor, chattering of the teeth, convulsions, hiccough, coldness of the extremities, trembling of the tongue, shrill voice, a sudden cessation of pain, with apparent tranquillity. The following are favourable: Sweats, apparently critical, breaking out; a seeming effort of nature to terminate the disease by a diarrhœa; a large hemorrhagy from the nose; swellings of the glands behind the ears; hæmorrhoids.

Cure. From what has been said of the theory of this disease, the cure must entirely depend on obtaining a resolution of the inflammation. The objects chiefly to be aimed at with this view are, 1. The removal of such exciting causes as continue to operate. 2. The diminution of the momentum of the blood in the circulating system in general. 3. The diminution of impetus at the brain in particular: and, 4. The avoiding circumstances which tend either to accelerate the motion of the blood or to give determination to the head.

Different practices may be used with these intentions; but here the most powerful remedies are to be immediately employed. Large and repeated bleedings are especially necessary; and these too taken from vessels as near as possible to the part affected. The opening the temporal artery has been recommended and with some reason: but as the practice is attended with some inconveniences, perhaps the opening of the jugular veins may prove more effectual; with which, however, may be joined the drawing of blood from the temples by cupping and scarifying. It is also probable, that purging may be of more use in this than in some other inflammatory affections, as it may operate by revulsion. For the same purpose of revulsion, warm pediluvia are a remedy, but rather ambiguous. The taking off the force of the blood in the vessels of the head by an erect posture is generally useful. Blistering is also useful, but chiefly when applied near to the part affected. In short, every part of the antiphlogistic regimen is here necessary, and particularly the admission of cold air. Even cold substances applied to the head have been found useful; and the application of such refrigerants as vinegar is certainly proper. Opiates are thought to be hurtful in every inflammatory state of the brain. On the whole, however, it must be remarked, that practitioners are very uncertain with regard to the means proper to be used in this disease; and the more so, that the symptoms by which the disease is commonly judged to be present, appear sometimes without any internal inflammation; and on the other hand, dissections have shown that the brain has been inflamed, where few of the peculiar symptoms of inflammation had appeared before.

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Genus X. CYNANCHE. 177

Cynanche, *Sauv.* gen. 110. *Lin.* 33. *Sag.* gen. 300.
Angina, *Vog.* 49. *Hoffm.* II 125. *Junck.* 30.
Angina inflammatoria, *Boerh.* 798.

Sp. I. Cynanche tonsillaris. 178
The *Inflammatory Quinsy.*

Cynanche tonsillaris, *Sauv.* sp. 1.
Anginæ inflammatoria, sp. 5. *Boerh.* 805.

Description. This is an inflammation of the mucous membrane of the fauces, affecting principally that congeries of mucous follicles which forms the tonsils; and from thence spreading along the velum and uvula, so as frequently to affect every part of the mucous membrane. The disease appears by some tumour and redness of the parts; is attended with a painful and difficult deglutition; a troublesome clamminess of the mouth and throat; a frequent but difficult excretion of mucus; and the whole is accompanied with pyrexia. The inflammation and tumor are commonly at first most considerable in one tonsil; and afterwards, abating in that, increase in the other. This disease is not contagious.

Causes of and persons subject to, this disorder. This disease is commonly occasioned by cold externally applied, particularly about the neck. It affects especially the young and sanguine; and a disposition to it is often acquired by habit. It occurs especially in the spring and autumn, when vicissitudes of heat and cold frequently take place.

Prognosis. This species of quinsy terminates frequently by resolution, sometimes by suppuration, but hardly ever by gangrene; though in some cases sloughy spots appear on the fauces: the prognosis therefore is generally favourable.

Cure. As the principal morbid affection in this disease, on which all its characterising symptoms immediately

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mediately depend, is the active inflammation in the tonsils and neighbouring parts, the object first and principally to be aimed at in the cure is to obtain a resolution of this inflammation. Sometimes, however, it is necessary to have recourse to practices, with the view of obviating urgent symptoms before a resolution can be effected: and in other cases, where a resolution cannot be obtained, it must be the aim of the practitioner to promote a speedy and favourable suppuration. After suppuration has taken place, the proper means of promoting a discharge of the purulent matter will conclude the cure. Here some bleeding may be necessary; but large and general evacuations are seldom beneficial. The opening of the ranular veins seems to be an insignificant remedy, according to Dr Cullen but is recommended as efficacious by Sir John Pringle: more benefit, however, may in general be derived from leeches to the external fauces. The inflammation may be often relieved by moderate astringents, and particularly by acids applied to the parts affected. In many cases, nothing has been found to give more relief than the vapour of warm water received into the fauces.

Besides these, blistering, and still more frequently rubefacient medicines, are applied with success, as well antiphlogistic purgatives; and every part of the antiphlogistic regimen is to be observed, except the application of cold. Sir John Pringle recommends a thick piece of flannel moistened with two parts of common sweet oil, and one of spirit of hartshorn (or in a larger proportion, if the skin will bear it), to be applied to the throat, and renewed once every four or five hours. By this means the neck, and sometimes the whole body, is put into a sweat, which after bleeding either carries off or lessens the inflammation. When the disease takes a tendency to suppuration, nothing will be more useful than the taking into the fauces the steams of warm water. Benefit is also obtained from poultices applied to the external fauces. When the abscess is attended with much swelling, if it break not spontaneously, it ought to be opened by a lancet; and this does not require much caution, as even the inflammatory state may be relieved by some scarification of the tonsils. When this disease runs very rapidly to such a height as to threaten suffocation, it is sometimes necessary to have recourse to bronchotomy as the only mean of saving the life of the patient. But there is reason to believe that this operation has sometimes been employed where it was not necessary: and we may safely venture to say, that it is but seldom requisite; insomuch that Dr Cullen tells us, that he has never in his practice seen any case requiring bronchotomy.

Sp. II. Cynanche maligna.

The *malignant, putrid,* or *ulcerous* sore throat.

Cynanche maligna, *Sauv.* sp. 3.
Cynanche ulcerosa, *Sauv.* var. a. Journ. de Med. 1758.
Cynanche gangrænosa, *Sauv.* var. b. Journ. de Med. 1756.
Ulcera faucium et gutturis anginosa et lethalia. Hispanis *Garrotillo, Lud. Mercat.* consult. 24.
Angina ulcerosa, *Fothergill*'s Account of the ulcerous sore throat, edit. 1751. *Huxham* on the malignant ulcerous sore throat, from 1751 to 1753.
Febris epidemica cum angina ulcusculosa, *Douglas*'s Practical History, Boston 1736.
Angina epidemica, *Russel*, Oecon. Natur. p. 105.
Angina gangrænosa, *Withering*'s Differt. Inaug. Edinb. 1766.
Angina suffocativa, *Bard*'s Inquiry, New-York, 1771.
Angina maligna, *Johnstone* on the malignant Angina, Worcester, 1779.

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History and description. This distemper is not particularly described by the ancient physicians; though perhaps the Syrian and Egyptian ulcers mentioned by Aretæus Cappadox, and the pestilent ulcerated tonsils we read of in Aeticus, Amideus were of this nature. Some of the scarlet fevers mentioned by Morton seem also to have approached near to it. In the beginning of the last century, a disease exactly similar to this is described by the physicians of that time, as raging with great violence and mortality in Spain and some parts of Italy; but no account of it was published in this country till the year 1748, when a very accurate one was drawn up by Dr Fothergill, and in 1752 by Dr Huxham. The latter observes, that this disease was preceded by long, cold, and wet seasons; by which probably the bodies of people were debilitated, and more apt to receive contagion, which possibly also might be produced by the stagnant and putrid waters.

The attack of this disease was very different in different persons. Sometimes a rigor, with fulness and soreness of the throat, and painful stiffness of the neck, were the first symptoms complained of. Sometimes alternate chills and heats, with some degree of giddiness, drowsiness, or head-ach, ushered in the distemper. It seized others with much more severish symptoms; great pain of the head, back, and limbs; a vast oppression of the præcordia, and continual sighing. Some grown persons went about for some days in a drooping state with much uneasiness and anxiety, till at last they were obliged to take to their beds.—Thus various was the disease, says Dr Huxham, at the onset. But it commonly began with chills and heats, load and pain of the head, soreness of throat, and hoarseness; some cough, sickness at stomach, frequent vomiting and purging, in children especially, which were sometimes very severe; though a contrary state was more common to the adult. There was in all a very great dejection of spirits, very sudden weakness, great heaviness on the breast, and faintness, from the very beginning. The pulse in general was quick, small, and fluttering, though sometimes heavy and undulating. The urine was commonly pale, thin, and crude; however in many grown persons, it was passed in small quantities and high-coloured, or like turbid whey. The eyes, were heavy, reddish, and as it were weeping; the countenance very often full, flushed, and bloated, though sometimes pale, and sunk.

How slight soever the disorder might appear in the day time, at night the symptoms became greatly aggravated, and the severish habit very much increased, nay, sometimes a delirium occurred on the very first night; and this exacerbation constantly returned thro' the whole course of the disease. Indeed, when it was considerably on the decline, our author says he has been often pretty much surprised to find his patient had

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had passed the whole night in a phrenzy, whom he had left tolerably cool and sedate in the day.

Some few hours after the seizure, and sometimes cotemporary with it, a swelling and soreness of the throat was perceived, and the tonsils became very tumid and inflamed, and many times the parotid and maxillary glands swelled very much, and very suddenly, even at the very beginning; sometimes so much as even to threaten strangulation. The fauces also very soon appeared of a high florid red, or rather of a bright crimson colour, very shining and glossy; and most commonly on the uvula, tonsils, velum palatinum, and back part of the pharynx, several whitish or ash-coloured spots appeared scattered up and down, which oftentimes increased very fast, and soon covered one or both the tonsils, uvula, &c. those in the event proved sloughs of superficial ulcers (which sometimes, however, eat very deep into the parts). The tongue at this time, though only white and moist at the top, was very foul at the root, and covered with a thick yellowish or brown coat. The breath also now began to be very nauseous; which offensive smell increased hourly, and in some became at length intolerable, and that too sometimes even to the patients themselves.

The second or third day every symptom became much more aggravated, and the fever much more considerable; and those that had struggled with it tolerably well for 30 or 40 hours, were forced to submit. The restlessness and anxiety greatly increased, as well as the difficulty in swallowing. The head was very giddy, pained, and loaded; there was generally more or less of a delirium; sometimes a pervigilium and perpetual phrenzy, though others lay very stupid, but often starting and muttering to themselves. The skin was very hot, dry, and rough; there was very rarely any disposition to sweat. The urine was pale, thin, crude; often yellowish and turbid. Sometimes a vomiting was urgent, and sometimes a very great looseness, in children particularly. The sloughs were now much enlarged, and of a darker colour, and the surrounding parts tended much more to a livid hue. The breathing became much more difficult; with a kind of a rattling stertor, as if the patient was actually strangling, the voice being exceeding hoarse and hollow, exactly resembling that from venereal ulcers in the fauces: this noise in speaking and breathing was so peculiar, that any person in the least conversant with the disease might easily know it by this odd noise; from whence indeed the Spanish physicians gave it the name of *garrotillo*, expressing the noise made by persons when they are strangled with a rope. Our author never observed in one of them the shrill barking noise that we frequently hear in inflammatory quinsies. The breath of all the diseased was very nauseous; of some insufferably fetid, especially in the advance of the distemper to a crisis; and many about the fourth or fifth day spit off a vast quantity of stinking purulent mucus tinged sometimes with blood; and sometimes the matter was quite livid, and of an abominable smell. The nostrils likewise in many were greatly inflamed and excoriated, continually dripping down a most sharp ichor or sanious matter, so excessively acrid, that it not only corroded the lips, cheeks, and hands of the children that laboured under the disease, but even the fingers and arms of the very nurses that attended them: as this ulceration of the nostrils came on, it commonly caused an almost incessant sneezing in the children; but few adults were affected with it, at least to any considerable degree. It was surprising what quantities of matter some children discharged this way, which they would often rub on their face, hands, and arms, and blister them all over. A sudden stoppage of this rheum from the mouth and nostrils actually choaked several cildren; and some swallowed such quantities of it, as occasioned excoriations of the intestines, violent gripings, dysentery, &c. nay, even excoriations of the anus and buttocks. Not only the nostrils, fauces, &c. were greatly affected by this extremely sharp matter, but the wind-pipe itself was sometimes much corroded by it, and pieces of its internal membrane were spit up, with much blood and corruption; and the patients lingered on for a considerable time, and at length died tabid; though there were more frequent instances of its falling suddenly and violently on the lungs, and killing in a peripneumonic manner.

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Dr Huxham was astonished sometimes to see several swallow with tolerable ease, though the tumour of the tonsils and throat, the quantity of thick mucus, and the rattling noise in breathing, were very terrible; which he thinks pretty clearly shows, that this malignant quinsy was more from the acrimony and abundance of the humours than the violence of the inflammation.

Most commonly the angina came on before the exanthemata; but many times the cuticular eruption appeared before the sore-throat, and was sometimes very considerable, though there was little or no pain in the fauces: on the contrary, a very severe angina seized some patients that had no manner of eruption; and yet, even in these cases, a very great itching and desquamation of the skin sometimes ensued; but this was chiefly in grown persons, very rarely in children. In general, however, a very considerable efflorescence broke out on the surface of the body, particularly in children; and it most commonly happened the second, third, or fourth day: sometimes it was partial, sometimes it covered almost the whole body, though very seldom the face: sometimes it was of an erysipelatous kind: sometimes more pustular: the pustules frequently eminent, and of a deep fiery red colour, particularly on the breast and arms; but oftentimes they were very small, and might be better felt than seen, and gave a very odd kind of roughness to the skin. The colour of the efflorescence was commonly of a crimson hue, or as if the skin had been smeared over with juice of rasberries, and this even to the fingers ends; and the skin appeared inflamed and swoln, as it were; the arms, hands, and fingers, were often evidently so, and very stiff, and somewhat painful. This crimson colour of the skin seemed indeed peculiar to this disease. Though the eruption seldom failed of giving some manifest relief to the patient, as to anxiety, sickness at stomach, vomiting, purging, &c. yet there was observed an universal fiery eruption on some persons, without the least abatement of the symptoms, nay almost every symptom seemed more aggravated, particularly the fever, load at breast, anxiety, delirium; and our author knew more than one or two patients die in the most raging phrenzy, covered with the most universal fiery rash he ever saw: so that, as in

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the highly confluent small-pox, it seemed only to denote the quantity of the disease, as he terms it.

He had under his care a young gentleman, about 12 years of age, whose tongue, fauces, and tonsils, were as black as ink, and he swallowed with extreme difficulty; he continually spit off immense quantities of a black, sanious, and very fetid matter, for at least eight or ten days:—about the seventh day, his fever being somewhat abated, he fell into a bloody dysentery, though the bloody, sanious, fetid expectoration still continued, with a most violent cough. He at length indeed got over it, to the very great surprise of every one that saw him. Now, in this patient, a severe and universal rash broke out upon the second and third day; and the itching of his skin was so intolerable, that he tore it all over his body in a most shocking manner: yet this very great and timely eruption very little relieved his fever and phrenzy, or prevented the other dreadful symptoms mentioned.

An early and kindly eruption, however, was most commonly a very good omen; and, when succeeded by a very copious desquamation of the cuticle, one of the most favourable symptoms that occurred; but when the eruption turned of a dusky or livid colour, or prematurely or suddenly receded, every symptom grew worse, and the utmost danger impended, especially if purple or black spots appeared up and down, as sometimes happened; the urine grew limpid, and convulsions came on, or a fatal suffocation soon closed the tragedy.

The disease was generally at the height about the fifth or sixth day in young persons, in the elder not so soon; and the crisis many times was not till the 11th or 12th, and then very imperfect: some adults, however, were carried off in two or three days; the distemper either falling on the lungs, and killing in a peripneumonic manner; or on the brain, and the patient either died raving or comatose. In some, the disease brought on a very troublesome cough, purulent expectoration, hæmoptoë, and hectic; in which they lingered on for several weeks, and then died tabid.

If a gentle easy sweat came on the third or fourth day; if the pulse became more slow, firm, and equal; if the sloughs of the fauces cast off in a kindly manner, and appeared at the bottom tolerably clean and florid; if the breathing was more soft and free, and some degree of vigour and quickness returned in the eyes; all was well, and a salutary crisis followed soon by a continuance of the sweat, and a turbid, subsiding, farinaceous urine, a plentiful expectoration, and a very large desquamation of the cuticle. But if a rigor came on, and the exanthemata suddenly disappeared or turned livid; if the pulse grew very small and quick, and the skin remained hot and parched as it were, the breathing more difficult, the eyes dead and glassy, the urine pale and limpid, a phrenzy or coma succeeded, with a coldish clammy sweat on the face or extremities; life was despaired of; especially if a singultus and choaking or gulping in the throat attended, with sudden, liquid, involuntary, livid stools, intolerably fetid. In some few patients Dr Huxham observed, some time before the fatal period, not only the face bloated, sallow, shining, and greasy as it were, but the whole neck very much swoln, and of a cadaverous look; and even the whole body became in some degree œdematous; and the impression of a finger would remain fixed in a part, the skin not rising again as usual; an indication that the blood stagnated in the capillaries, and that the elasticity of the fibres was quite lost.

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Medical writers are still much divided in opinion, whether the cynanche maligna is to be considered as the same disease with the scarlatina anginosa, afterwards to be treated of, or not. This question will afterwards come to be more fully discussed. At present we may only observe, that although ulcerous sore throats of a malignant nature often appear sporadically, yet that the disease above described appears only as an epidemic, and is always the consequence of contagion.

Prognosis. This may be easily gathered from the above description. The malignant and putrid tendency of the disease is evident, and an increase of the symptoms which arise from that putrescent disposition of the body must give an unfavourable prognostic; as, on the contrary, a decrease of these, and an apparent increase of the *vis vitæ*, are favourable: in general, what is observed to be favourable in the nervous and putrid malignant fevers, is also favourable in this and *vice versa*.

Causes. Since the accurate accounts given by Dr Fothergill and Huxham of the epidemics which prevailed about 50 years ago, this disease has frequently been observed at times epidemic in almost every different part of Britain. Like small pox, measles, and chincough, it seems in every case to be the effect of a peculiar and specific contagion. It has been observed to prevail, equally generally in every situation, and at every season; and on exposure to the contagion, no age, sex, or condition, is exempted from it. But the having once had the disease, seems in this affection to afford the same security against future contagion as in the small-pox: at least instances, where it can be said that the same individual has been twice affected with it, are both very rare and very doubtful, as well as in small-pox.

Cure. Like other febrile contagions, the malignant ulcerous sore throat is terminated only by a natural course; and the chief business of the practitioner is to combat unfavourable occurrences. In this the septic tendency of the disease is chiefly to be kept in view. The debility with which it is attended renders all evacuations by bleeding and purging improper, except in a few instances where the debility is less, and the inflammatory symptoms more considerable. The fauces are to be preserved from the effects of the acrid matter poured out upon them, and are therefore to be frequently washed out by antiseptic gargles or injections; and the putrescent state of the whole system should be guarded against and corrected by internal antiseptics, especially by the Peruvian bark given in the beginning and continued through the course of the disease. Great benefit is also often derived from the liberal use of the mineral acids. Both the vitriolic and muriatic, in a state of proper dilution, have been highly extolled by different medical writers, and are productive of the best effects in actual practice, when they can be introduced to a sufficient extent. Emetics, both by vomiting and nauseating, prove useful. When any considerable tumor occurs, blisters applied exter-

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externally will be of service, and in any case may be proper to moderate the inflammation.

Very lately, the internal use of the capsicum annuum, or Cayenne pepper as it is commonly called, has been highly celebrated in this affection; and it is particularly said to have been employed with singular success in the West Indies.

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Sp. III. Cynanche trachealis. The Croup

Cynanche trachealis, *Sauv.* sp. 5.
Cynanche laryngea auctorum, *Aller* de cogn. et curand. morb. sect. 7.
Anginæ inflammatoriæ, sp. 1. *Boerh.* 801.
Angina latens et difficilis, *Dodon.* obs. 18.
Angina interna, *Vulp.* l. 1. obs. 51.
Angina perniciosa, *Greg. Horst.* Obs. l. iii. obs. 1.
Suffocatio stridula, *Home* on the Croup.
Asthma infantum, *Millar* on the Asthma and Chincough.
Asthma infantum spasmodicum, *Rush*, Dissertatio, Lond. 1770.
Cynanche stridula, *Crawford* Dissert. Inaug. Edin. 1771.
Angina epidemica anno 1743. *Molloy* apud *Rutty's* History of the weather.
Morbus strangulatorius, *Starr*, Phil. Trans. n° 495. Morbus truculentus infantum, *Francof.* ad Viadrum et in vicinia grassans ann. 1758. C. a Bergen. A nova. N. C. tom. ii. p. 157.
Catarrhus suffocativus Barbadensis ann. 1758. *Hillary's* Diseases of Barbadoes.
Angina inflammatoria infantum, *Russel*, Oecon. nat. p. 70.
Angina polyposa sive membranacea *Michealis*. Argentorati 1778, et auctores ab eo allegati.

The best description of this disease we have in Dr Cullen's Practice of Physic. He informs us, that it consists in an inflammation of the glottis, larynx, or upper part of the trachea, whether it affect the membranes of these parts or the muscles adjoining. It may arise first in these parts, and continue to subsist in them alone; or it may come to affect these parts from the cynanche tonsillaris, or maligna, spreading into them.

In either way it has been a rare occurrence, and few instances of it have been marked and recorded by physicians. It is to be known by a peculiar croaking sound of the voice, by difficult respiration, with a sense of straitening about the larynx, and by a pyrexia attending it.

From the nature of these symptoms, and from the dissection of the bodies of persons who died of this disease, there is no doubt of its being of an inflammatory kind. It does not, however, always run the course of inflammatory affections; but frequently produces such an obstruction of the passage of the air, as suffocates, and thereby proves suddenly fatal.

It particularly proves fatal, in consequence of the trachea being obstructed by a membranous substance lining the inside of it, and very nearly approaching in appearance to the inflammatory exudation often discovered on the intestinal canal in those dying of enteritis.

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If we judge rightly of the nature of this disease, it will be obvious, that the cure of it requires the most powerful remedies of inflammation to be employed upon the very first appearance of the symptoms. When a suffocation is threatened, whether any remedies can be employed to prevent it, is not yet determined by sufficient experience: but it is evident, that in certain cases the life of the patient can be preserved only by the removal of that matter which obstructs the passage of air through the trachea.

The accounts which books have hitherto given us of inflammations of the larynx, and the parts connected with it, amount to what we have now said; and many instances are recorded of the disease happening in adult persons: but there is a peculiar affection of this kind happening to infants which has been little taken notice of till lately. Dr Home is the first who has given any distinct account of this disease; but since he wrote, several other authors have taken notice of it, and have given different opinions concerning it.

This disease seldom attacks infants till after they have been weaned. After this period, the younger they are, the more they are liable to the disease. The frequency of it becomes less as children become more advanced; and there are few instances of children above 12 years of age being affected with it. It attacks children of the midland countries, as well as those who live near the sea; but it occurs much more frequently at certain places than at others. It does not appear to be contagious; and its attacks are frequently repeated in the same child. It is often manifestly the effects of cold applied to the body; and therefore appears most frequently in the winter and spring seasons. It very commonly comes on with the ordinary symptoms of a catarrh; but sometimes the peculiar symptoms of the disease show themselves at the very first.

These peculiar symptoms are the following: A hoarseness, with some shrillness and ringing sound, both in speaking and coughing, as if the noise came from a brazen tube. At the same time, there is a sense of pain about the larynx, some difficulty of respiration, with a whizzing sound in inspiration, as if the passage of the air were straitened. The cough which attends it, is commonly dry; and if any thing be spit up, it is a matter of a purulent appearance, and sometimes films resembling portions of a membrane. With all these symptoms, there is a frequency of pulse, a restlessness, and an uneasy sense of heat. When the internal fauces are viewed, they are sometimes without any appearance of inflammation; but frequently a redness, and even swelling, appears; and sometimes there is an appearance of matter like to that rejected by coughing, together with the symptoms now described, and particularly with great difficulty of breathing, and a sense of strangling in the fauces, by which the patient is sometimes suddenly taken off.

Many dissections have been made of infants who had died of this disease, and almost constantly there has appeared a preternatural substance, apparently membranous, lining the whole internal surface of the upper part of the trachea, and extending in the same manner

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manner downwards into ſome of its ramifications. This preternatural membrane may be eaſily ſeparated, and ſometimes has been found ſeparated in part, from the ſubjacent proper membrane of the trachea. This laſt is commonly found entire, that is, without any appearance of eroſion or ulceration; but it frequently ſhows the veſtiges of inflammation, and is covered by a matter reſembling pus, like to that rejected by coughing; and very often a matter of the ſame kind is found in the bronchiæ, ſometimes in conſiderable quantity.

From the remote cauſes of this diſeaſe; from the catarrhal ſymptoms commonly attending it, from the pyrexia conſtantly preſent with it; from the ſame kind of preternatural membrane being found in the trachea when the cynanche maligna is communicated to it; and from the veſtiges of inflammation on the trachea diſcovered upon diſſection; we muſt conclude, that this diſeaſe conſiſts in an inflammatory affection of the mucous membrane of the larynx and trachea, producing an exudation analogous to that found on the ſurface of inflamed viſcera, and appearing partly in a membranous cruſt, and partly in a fluid form reſembling pus.

Though this diſeaſe conſiſts in an inflammatory affection, it does not commonly end either in ſuppuration or gangrene. The troubleſome circumſtance of it ſeems to conſiſt in a ſpaſm of the muſcles of the glottis, threatening ſuffocation.

When this diſeaſe terminates in health, it is by reſolution of the inflammation, by ceaſing of the ſpaſm of the glottis, by an expectoration of the matter exuding from the trachea, and of the cruſts formed there, and frequently it ends without any expectoration, or at leaſt with ſuch only as attends an ordinary catarrh. But in ſome inſtances, a ſalutary termination has very ſpeedily taken place, in conſequence of the diſcharge of the membranous ſubſtance from the trachea, even under its proper tubular form.

When the diſeaſe ends fatally, it is by a ſuffocation ſeemingly depending upon a ſpaſm affecting the glottis; but ſometimes, probably, depending upon a quantity of matter filling the bronchiæ, or obſtructing the trachea.

As we ſuppoſe the diſeaſe to be an inflammatory affection, ſo we attempt the cure of it by the uſual remedies of inflammation. Bleeding, both general and topical, has often given immediate relief, and by being repeated, has entirely cured the diſeaſe. Bliſtering alſo, near to the part affected, has been found uſeful. Upon the firſt attack of the diſeaſe, vomiting, immediately after bleeding, ſeems to be of conſiderable uſe, and ſometimes ſuddenly removes the diſeaſe. But emetics are ſtill more uſeful in advanced periods. By the employment of theſe, the matter obſtructing the trachea, and inducing ſpaſmodic affections, has often been ſucceſsfully removed, when the ſituation of the patient ſeemed to be almoſt deſperate. And as in the progreſs of the diſeaſe freſh effuſions of this matter are very apt to take place, the frequent repetition of emetics becomes neceſſary. It is often neceſſary to have recourſe to thoſe operating the moſt expeditiouſly, ſuch as vitriolated zinc even in large doſes. In every ſtage of the diſeaſe, the antiphlogiſtic regimen is neceſſary, and particularly the frequent uſe of laxative glyſters. Though we ſuppoſe that a ſpaſm affecting the glottis is often fatal in this diſeaſe, antiſpaſmodic medicines have not in general been found of great ſervice. Some, however, have ſtrongly recommended the uſe of aſafœtida under the form of injection; others place great confidence in oil, or oily mixtures taken by the mouth: but more immediate benefit is derived from tepid bathing, and the employment of vitriolic ether, both externally and internally.

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Sp. IV. Cynanche pharyngea. 181

Cynanche pharyngea, *Sauv.* ſp. 6. *Eller* de cogn. et cur. ſect. 7.
Anginæ inflammatoriæ, ſp. 4. *Boerh.* 804.

This is not materially different from the cynanche tonſillaris; only that the inflammation is ſaid to begin in the pharynx, though Dr Cullen ſays he never knew an inſtance of it. The ſymptoms are almoſt the ſame, and the cure is preciſely ſo with that of the cynanche tonſillaris.

Sp. V. Cynanche parotidæa. 182

Cynanche parotidæa, *Sauv.* ſp. 14. *Gallis* Oreillons et Ourles, *Tiſſot* Avis au peuple, n° 116. *Encyclopedie*, au mot *Oreillons*.
Angina externa, *Anglis* the Mumps, *Ruſſel* œcon. natur. p. 114. *Scotis* the Branks.
Catarrhus Bellinſulanus, *Sauv.* ſp. 4.
Oſſervazioni di *Girol. Gaſpari*, Venez. 1731.
Oſſervazioni di *Targ. Tozetti*, Racolta 1 ma, p. 176.

This is a diſeaſe well known to the vulgar, but little taken notice of by medical writers. It is often epidemic, and manifeſtly contagious. It comes on with the uſual ſymptoms of pyrexia, which is ſoon after attended with a conſiderable tumour of the external fauces and neck. The ſwelling appears firſt as a glandular moveable tumour at the corner of the lower jaw; but it ſoon becomes uniformly diffuſed over a great part of the neck, ſometimes on one ſide only, but more commonly on both. The ſwelling continues to increaſe till the fourth day; but from that period it declines, and in a few days more goes off entirely. As the ſwelling of the fauces recedes, it not unfrequently happens that ſome tumour affects the teſticles in the male ſex, or the breaſts in the female. Theſe tumours are ſometimes large, hard, and ſomewhat painful; but are ſeldom either very painful or of long continuance. The pyrexia attending this diſeaſe is commonly ſlight, and goes off with the ſwelling of the fauces; but ſometimes, when the ſwelling of the teſticles does not ſucceed to that of the fauces, or when the one or the other has been ſuddenly repreſſed, the pyrexia becomes more conſiderable, is often attended with delirium, and has ſometimes proved fatal.

As this diſeaſe commonly runs its courſe without either dangerous or troubleſome ſymptoms, ſo it hardly requires any remedies. An antiphlogiſtic regimen, and avoiding cold, are all that will be commonly neceſſary. But when, upon the receding of the ſwellings, the pyrexia comes to be conſiderable, and threatens an affection of the brain, it will be proper, by warm fomentations,

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mentations, to bring back the swelling; and by vomiting, bleeding, or blistering, to obviate the consequences of its absence.

183 GENUS XI. PNEUMONIA.

Febris pneumonica, *Hoffm.* II. 136.

184 Sp. I. PERIPNEUMONIA
Peripneumony, or Inflammation of the LUNGS.

Peripneumonia, *Sauv.* gen. 112. *Lin.* 34. *Vog.* 51. *Sag.* gen. 311. *Boerh.* 820. *Juncker* 67.
Peripneumonia pura sive vera Auctorum, *Sauv.* sp. 1.
Peripneumonia gastrica, *Sauv.* sp. 11. *Morgagn.* de caus. et sed. Epist. xx. art. 30, 31.
Peripneumonia catarrhalis, *Sauv.* sp. 6.
Peripneumonia notha, *Sydenh.* sect. 6. cap. 4. *Boerh.* 867. *Morgagni* de caus. et sed. Epist. xxi. 11.—15.
Peripneumonia putrida, *Sauv.* sp. 2.
Peripneumonia ardens, *Sauv.* sp. 3.
Peripneumonia maligna, *Sauv.* sp. 4.
Peripneumonia typhodes, *Sauv.* sp. 5.
Amphimerina peripneumonica, *Sauv.* sp. 15.

185 Sp. II. PLEURITIS.
The *Pleurisy*, or Inflammation of the PLEURA.

Pleuritis, *Sauv.* gen. 103. *Lin.* 27. *Vog.* 56. *Sag.* gen. 303. *Boerh.* 875. *Junck.* 67
Paraphrenesis, *Sauv* gen. 102. *Lin.* 26.
Paraphrenitis, *Vog.* 55. *Boerh.* 907.
Diaphragmitis, *Sag.* gen. 304.
Pleuritis vera, *Sauv.* sp. 1. *Boerh.* 875. *Verna.* princepts morb. acut. pleuritas, l. 1. cap. 2. 3. *Zeviani* della parapleuritide, cap. 3. *Morgagni* de sed. et caus. morb. Epist. xx. art. 56. xxi. 45. *Wendt* de pleuritide, apud *Sandifort*, thes. ii.
Pleuritis pulmonis, *Sauv.* sp. 2. *Zevian.* dell. parapleur. iii. 28, &c.
Pleuropneumonia, pleuro-peripneumonia, peripneumo-pleuritis Auctorum. *Baronius* de pleuri-pneumonia. Ill. *Halleri* opuscul. patholog. obs. 13. *Morgagni* de sed. et caus. Epist. xx. and xxi. passim. *Cleghorn*, Minorca, p. 247. *Triller* de pleuritide, aph. 1, 2, 3 cap. i. 8. *Huxham*, Dissert on pleurisies, &c. chap. i. Ill. *Pringle*, Dis. of the army.
Pleuritis convulsiva, *Sauv.* sp. 13. *Bianch.* Hist. hep. vol. i. p. 234.
Pleuritis hydrothoracica. *Sauv.* sp 15. *Morgagni* de caus. et sed. xx. 34.
Pleuritis dorsalis, *Sauv.* sp. 3. *Verna*, p. 3. cap. 8.
Pleuritis mediastini, *Sauv.* sp. 3. *P. Sal. Div.* de affec. part. cap. 6. *Friend*, Hist. Med. de Avenzoare.
Mediastina, *Vog.* 52.
Pleuritis pericardii, *Sauv.* sp. 5. *Verna*, p. iii. cap, 9.
Parapleuritis, *Zeviani* della parapleuritide.
Pleurodyne parapleuritis, *Sauv.* sp. 19.
Paraphrenesis diaphragmatica, *Sauv.* sp. 1. *De Haen.* Rat. med. i. 7. iii. p. 31.
Paraphrenesis pleuritica, *Sauv.* sp. 2.
Paraphrenesis hepatica, *Sauv.* sp. 3.

Pneumonia.

Under the general head of *Pneumonia*, Dr Cullen comprehends all inflammations of the thoracic viscera, or membrane lining the inside of that cavity; as the symptoms do not sufficiently distinguish the seat of the affection, nor does a difference in the situation of the affected place make any difference in the cure.

Description. Pneumonic inflammation, however various in the seat, always discovers itself by pyrexia, difficult breathing, cough, and pain in some part of the thorax. It almost always comes on with a cold stage, and is accompanied with the other symptoms of pyrexia; though in some few instances the pulse may not be more frequent, nor the heat of the body increased beyond what is natural. Sometimes the pyrexia is from the beginning accompanied with the other symptoms; but frequently it is formed some hours before them, and particularly before the pain be felt. The pulse for the most part is frequent, full, strong, hard, and quick; but, in a few instances, especially in the advanced state of the disease, it is weak, soft, and at the same time irregular. The difficulty of breathing is most considerable in inspiration, both because the lungs do not easily admit of a full dilatation, and because the dilatation increases the pain attending the disease. The difficulty of breathing is also greater when the patient is in one posture of the body rather than another. It is generally greater when he lies on the side affected; though sometimes the contrary happens. Very often the patient cannot lie easy upon either side, and can find ease only when lying on the back; and sometimes he cannot breathe easily, except when in somewhat of an erect posture. The cough, in different cases, is more or less urgent or painful. It is sometimes dry, or without any expectoration, especially in the beginning of the disease; but more commonly it is, even from the beginning, moist, and the matter spit up various both in consistence and colour, and frequently it is streaked with blood. The pain is also different in different cases, and felt in different parts of the thorax, but most frequently in one side. It has been said to affect the right side more frequently than the left; but this is uncertain, and we are sure that the left side has been very often affected. Sometimes it is felt as if it was under the sternum; sometimes in the back between the shoulders; and when in the sides, its place has been higher or lower, more forward or backward; but the place of all most frequently affected is about the sixth or seventh rib, near the middle of its length, or a little more forward. The pain is often severe and pungent; but sometimes more dull and obtuse, with a sense of weight rather than of pain. It is most especially severe and pungent when occupying the place last mentioned. For the most part it continues fixed in one part, but sometimes shoots from the side to the scapula on one hand, or to the sternum and clavicle on the other.

Dr Cullen supposes that the disease is always seated, or at least begins, in some part of the pleura, taking that membrane in its greatest extent, as now commonly understood; that is, as covering not only the internal surface of the cavity of the thorax, but also as forming the mediastinum, and as extended over the pericardium, and over the whole surface of the lungs. But as the symptoms never clearly indicate where

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where the seat of the disease is, there is but little foundation for the different names by which it has been distinguished. The term *pleurisy* is improperly limited to that inflammation which begins in and chiefly affects the pleura costalis. This our author thinks is a rare occurrence; and that the pneunomia much more frequently begins in the pleura investing the lungs, producing all the symptoms which belong to what hath been called the *pleuritis vera*. The word *peripneumony* has been applied to an inflammation beginning in the parenchyma, or cellular texture of the lungs, and having its seat chiefly there. But to Dr Cullen it seems very doubtful if any acute inflammation of the lungs, or any disease which has been called *peripneumony*, be of that kind. It seems probable, that every acute inflammation begins in membranous parts; and in every dissection of persons who have died of peripneumony, the external membrane of the lungs, or some part of the pleura, has appeared to have been considerably affected. An inflammation of the pleura covering the upper surface of the diaphragm, has been distinguished by the appellation of *paraphrenitis*, as supposed to be attended with the peculiar symptoms of delirium, *risus sardonicus*, and other convulsive motions: but it is certain, that an inflammation of that portion of the pleura, and affecting also even the muscular substance of the diaphragm, has often taken place without any of the symptoms abovementioned; and neither the dissections which have fallen under Dr Cullen's observation, nor any accounts of dissections, support the opinion that an inflammation of the pleura covering the diaphragm is attended with delirium more commonly than any other pneumonic inflammation.---It is to be observed however, that though the inflammation may begin in one particular part of the pleura, the morbid affection is commonly communicated to the whole extent of the membrane.

The pneumonic inflammation, like others, may terminate by resolution, suppuration or gangrene: but it has also a termination peculiar to itself; namely, when it is attended with an effusion of blood into the cellular texture of the lungs, which, soon interrupting the circulation of the blood through the viscus, produces a fatal suffocation. This indeed appears to be the most common termination of pneumonic inflammation when it ends fatally; for upon the dissection of almost every person who has died of this disease, it appears that such an effusion had happened. From the same dissections we learn, that pneumonic inflammation commonly produces an exsudation from the internal surface of the pleura, which appears partly as a soft viscid crust, often of a compact membranous form, covering every where the surface of the pleura, and particularly those parts where the lungs adhere to the pleura costalis, or mediastinum; and this crust seems always to be the cement of such adhesion. The same exsudation shows itself also by a quantity of a serous fluid commonly found in the cavity of the thorax; and some exsudation or effusion is usually found to have been made into the cavity of the pericardium. It seems likewise probable, that an effusion of this kind is sometimes made into the cavity of the bronchiæ; for in some persons who have died after labouring under a pneumonic inflammation for a few days only, the bronchiæ have been found filled with a considerable quantity of serous and thickish fluid, which must be considered rather as the effusion abovementioned, having had its thinner parts taken off by respiration, than as a pus so suddenly formed in the inflamed part. It is, however, not improbable, that this effusion, as well as that made into the cavities of the thorax and pericardium, may be a matter of the same kind with that which in other inflammations is poured into the cellular texture of the parts inflamed, and there converted into pus; but in the thorax and pericardium it does not always put on this appearance, because the crust covering the surface prevents the absorption of the thinner part. This absorption, however, may be compensated in the bronchiæ, by the drying power of the air; and therefore the effusion into them may assume a more purulent appearance. In many cases of pneumonic inflammation, when the expectoration is very copious, it is difficult to suppose that the whole proceeds from the mucous follicles of the bronchiæ; and it seems probable that a great part of it may come from the effused serous fluid just mentioned; and this too will account for the appearance of the expectoration being so often purulent. Perhaps the same thing will account for that purulent matter found in the bronchiæ, which Mr de Haen says he had often observed when there was no ulceration in the lungs, and which he accounts for in a very strange manner, namely, by supposing a pus formed in the circulating blood.

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Dr Cullen is of opinion, that the effusion into the bronchiæ abovementioned often concurs with the effusion of red blood into the cellular substance of the lungs to occasion the fatal suffocation which frequently terminantes peripneumony: that the effusion of serum alone may have this effect: and that the serum poured out in a certain quantity, rather than any debility in the powers of expectoration, is the cause of that cessation of spitting which precedes the fatal event; for in many cases the expectoration has ceased, when no other symptoms of debility have appeared, and when, upon, dissection, the bronchiæ have been full of liquid matter. Nay, it is even probable, that in some cases such an effusion may take place without any symptoms of violent inflammation; and in other cases the effusion taking place may seem to remove the symptoms of inflammation which had appeared before, and thus account for those unexpected fatal terminations which have sometimes happened.

Pneumonic inflammation seldom terminates by resolution, without being attended with some evident evacuation. An hæmorrhagy from the nose happening on some of the first days of the disease has sometimes put an end to it; and it is said, that an evacuation from the hæmorrhoidal veins, a bilious evacuation by stool, and an evacuation of urine with a copious sediment, have severally had the same effect; but such occurrences have been rare. The evacuation most frequently attending, and seeming to have the greatest effect in promoting resolution, is an expectoration of a thick, white, or yellowish matter, a little streaked with blood, copious, and brought up without much or violent coughing. Very frequently the resolution of this disease is attended with, and perhaps produced by, a sweat which is warm, fluid, copious, over the whole body, and attended with an abatement of the frequency of

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the pulse, heat of the body, and other febrile symptom. Although, from the history now given, it appears that pleurisy and peripneumony cannot with propriety be considered as different diseases, yet it is certain that in different cases this affection occurs with an assemblage of symptoms separate and distinct. Thus even Dr Cullen himself, in his Nosology, has defined pleuritis to consist in pyrexia, attended with pungent pain of the side, painful respiration, difficulty of lying down particularly on the affected side, and distressing cough, in the begining dry, but afterwards humid, and often with bloody expectoration. While again he has defined peripneumony to consist in pyrexia, attended with a dull pain under the sternum and between the shoulders, anxiety, difficulty of breathing, humid cough, expectoration generally bloody, a soft pulse, and a tumid livid appearance of the countenance. It is highly probable, that the first of these sets of symptoms chiefly arises from a state of active inflammation, and the second from effusion. Thus, in certain cases the symptons may appear perfectly seperate and distinct; but more frequently both inflammation and effusion are united; and thus the symptoms in both definitions are in general combined in the same patient.

Causes of, and persons subject to, this disorder. The remote cause of pneumonic inflammation is commonly cold applied to the body, obstructing perspiration, and determining to the lungs, while at the same time the lungs themselves are exposed to the action of cold. These circumstances operate chiefly when an inflammatory diathesis, prevails in the system; and therefore those principally affected with the disease are persons of the greatest vigour, in cold climates, in the winter season, and particularly in the spring, when vicissitudes of heat and cold are frequent. This disease, however may arise in any season when such varieties take place. Other remote causes also may have a share in producing this distemper; such as every means of obstructing straining, or otherwise injuring, the pneumonic organs. The pneumonic inflammation has sometimes been so much an epidemic, that it hath been suspected of depending on a specific contagion; but Dr Cullen never met with an instance of its being contagious.

Prognosis. In pneumonic inflammations, a violent pyrexia is always dangerous. The danger, however is chiefly denoted by the difficulty of breathing. When the patient can lie on one side only; when he can lie on neither side, but only on his back; when he cannot breathe with tolerable ease, except when the trunk of his body is erect; when even in this posture the breathing is very difficult, and attended with a turgescence and flushing of the face, partial sweats about the head and neck, and an irregular pulse; these circumstances mark the difficulty of breathing in different degrees; and consequently, in proportion, the danger of the disease. A frequent violent cough, aggravating the pain, is always the symptom of an obstinate disease; and as the disease is seldom or never resolved without some expectoration, so a dry cough must always be an unfavourable symptom.

The proper characteristics of the expectoration have been already laid down; and though an expectoration which has not these marks must indicate a doubtful state of the disease, yet the colour alone can give no certain prognostic. An acute pain, very much interrupting inspiration, is always the mark of a violent disease; but not of a more dangerous disease than an obtuse pain attended with very difficult respiration.

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When the pains, which had at first affected one side only, shall afterwards spread into the other; or when, leaving the side first affected, they pass entirely into the other; these are always marks of a dangerous disease. A delirium coming on during a pneumonic inflammation is always a symptom denoting much danger.

When pneumonic disorders teminate fatally, it is on one or other of the days of the first, week, from the third to the seventh. This is the most common case; but, in a few instances, death has happened at a later period. When the disease is violent, but admitting of resolution, this also happens frequently in the course of the first week; but in a more moderate disease the resolution is often put off to the second week. The disease generally suffers a remission on some of the days from the third to the seventh: which, however, may be often fallacious, as the disease sometimes returns again with as much violence as before; and in such a case with great danger. Sometimes it disappears on the third day, while an erysipelas makes its appearance on some external part; and if this continue fixed, the pneumonic inflammation does not recur. If the disease continue beyond the 14th day, it will terminate in a suppuration, or PHTHISIS. The termination by gangrene is much more rare than has been imagined: and when it does occur, it is usually joined with the termination by effusion: the symptoms of the one being hardly distinguishable from those of the other.

Cure. This must proceed upon the general plan mentioned under SYNOCHA; but, on account of the importance of the part affected, the remedies must be employed early, and as fully as possible; and these are chiefly directed with one of three views, viz, for obtaining a resolution of the inflammation in the thorax, for mitigating the urgent symptoms before a resolution can be effected, and for counteracting or obviating the consequences of the disease. Venesection is the remedy chiefly to be depended on; and may be done in either arm, as the surgeon finds most convenient; and the quantity taken away ought in general to be as large as the patient's strength will allow. The remission of pain, and the relief of respiration, during the flowing of the blood, may limit the quantity to be then drawn; but if these symptoms of relief do not appear, the bleeding should be continued to a considerable extent unless symptoms of a beginning syncope come on. It is seldom that one bleeding, however large, will cure this disease; and though the pain and difficulty of breathing may be much relieved by the first bleeding, these symptoms commonly and after no long interval recur, often with as much violence as before. In this case the bleeding is to be repeated even on the same day, and perhaps to the same quantity as before. Sometimes the second bleeding may be larger than the first. There are persons who, by their constitution, are ready to faint, even upon a small bleeding; and in such persons this may prevent the drawing so much blood at first as a pneumonic inflammation may require: but as the same persons are

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found to bear after bleedings better than the first, this allows the second and subsequent bleedings to be larger, and to such a quantity as the symptoms of the disease may seem to require.

Bleedings are to be repeated according to the state of the symptoms, and they will be more effectual when practised in the course of the first three days than afterwards; but they are not to be omitted though four days of the disease may already have elapsed. If the phisician has not been called in time, or the first bleedings have not been sufficiently large, or even though they should have procured some remission, yet upon the return of the urgent symptoms, bleeding may be repeated at any time within the first fortnight, or even after that period, if a suppuration be not evident, or if after a seeming solution the disease shall have returned.

With respect to the quantity of blood which may be taken away with safety, no general rules can be given; as it must be very different according to the state of the disease, and the constitution of the patient. In an adult male of tolerable strength a pound avoirdupois of blood is a full bleeding. Any quantity above 20 ounces is a large, and any quantity below 12 is a small, bleeding. An evacuation of four or five pounds in the course of two or three days, is generally as much as most patients will bear; but if the intervals between the bleedings, and the whole of the time during which the bleedings have been employed, have been long the quantity taken upon the whole may be greater.

When a large quantity of blood hath been taken from the arm, and it is doubtful if more can be taken in that manner with safety, some blood may still be taken by cupping and scarifying. This will especially be proper, when the recurrence of the pain, rather than the difficulty of breathing, becomes the urgent symptom; and then the cupping and scarification should be made as near as possible to the pained part.

An expectoration sometimes takes place very early in this disease; but if the symptoms continue urgent, the bleedings must be repeated notwithstanding the expectoration: but in a more advanced state, and when the symptoms have suffered a considerable remission, we may then trust the cure to the expectoration alone. It is not observed that bleeding, during the first days of the disease, stops expectoration; on the contrary, it hath been often found to promote it; and it is only in a more advanced state of the disease, when the patient has been already exhausted by large evacuations and a continuance of his illness, the bleeding seems to put a stop to expectoration; and even then, this stoppage seems not to take place so much from the powers of expectoration being weakened by bleeding, as by its favouring the serous effusion in the bronchiæ, already taken notice of.

Besides bleeding, every part of the antiphlogistic regimen ought here to be carefully employed: the patient must keep out of bed as much as he can bear; must have plenty of warm diluting drinks, impregnated with vegetable acids, accompanied with nitre or some other cooling neutral salt: and the belly also ought to be kept open by emollient glysters or cooling laxative medicines. Vomiting in the beginning is dangerous; but in a somewhat advanced state of the disease emetics have been found the best means of promoting expectoration. Fomentations and poultices to the pained part have been found useful; but blistering is found to be much more effectual. A blister, however, ought not to be applyed till at least one bleeding hath been premised, as venesection is less effectual when the irritation of a blister is present. If the disease be moderate, a blister may be applied immediately after the first bleeding; but in violent cases, where it may be presumed that a second bleeding may soon be necessary after the first, it will be proper to delay the blister till after the second bleeding, when it may be supposed that the irritation occasioned by the blister will be over before another bleeding becomes necessary. It may frequently be of use in this disease to repeat the blistering; and in that case the plasters should always be applied somewhere on the thorax, for when applied to more distant parts they have little effect. The keeping the blistered parts open, and making what is called a *perpetual blister*, has much less effect than a repeated blistering.

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Many methods have been proposed for promoting expectoration, but none appear to be sufficiently effectual; and some of them, being acrid stimulant substances, are not very safe. The gums usually employed seem to be too heating; the squills less so; but they are not very powerful, and sometimes inconvenient, by the constant nausea they occasion. The volatile alkali may be of service as an expectorant, but it ought to be reserved for an advanced state of the disease. Mucilaginous and oily demulcents appear to be useful, by allaying that acrimony of the mucus which occasions too frequent coughing; and which coughing prevents the stagnation and thickening of the mucus, and thereby its becoming mild. The receiving into the lungs the steams of warm water, impregnated with vinegar, has often proved useful in promoting expectoration; and, for this purpose, the machine called the INHALER, lately invented by Dr Mudge of Plymouth, promises to be of great service. But of all others, the antimonial emetics given in nauseating doses, promise to be the most powerful for premoting expectoration. The kermes mineral has been greatly recommended; but doth not seem to be more efficacious than emetic tartar or antimonial wine; and the dose of the kermes is much more uncertain than that of the others.

Though this disease often terminates by a spontaneous sweating, the evacuation ought not to be excited by art, unless with much caution. When, after some remission of the symptoms, spontaneous sweats arise, they may be encouraged; but it ought to be without much heat, and without stimulant medicines. If, however, the sweats be partial and clammy only, and a great difficulty of breathing still remain, it will be very dangerous to encourage them.

Physicians have differed much with regard to the use of opiates in pneumonic affections. it appears, however, that, in the beginning of the disease, and before bleeding and blistering have produced some remission of the pain, and of the difficulty of breathing, opiates have a bad tendency, by their increasing the difficulty of breathing and other inflammatory symptoms. But in a more advanced state of the disease, when the difficulty of breathing has abated, and when the urgent symptom is a cough, proving the chief cause of the continuance of pain and want of

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rest, opiates may be employed with great advantage and safety. The interruption of the expectoration which they seem to occasion, is for a short time only; and they seem often to promote it, as they occasion a stagnation of what was by frequent coughing dissipated insensibly: and therefore give the appearance of what physicians have called *concocted matter*.

Opium combined with calomel has of late been highly extolled in this and other inflammatory diseases by Dr Hamilton of Lynn-Regis; who has given a full account of the success attending his practice with this remedy, for the space of 16 years, in the 9th volume of the Edinburgh Medical Commentaries. And since his recommendation, the same remedy has often been employed by others with great benefit.

186 *Vomica*, or *Abscess* of the *Lungs*.

Vomica, *Boerh.* 835, *Junck.* 35.
Pleurodyne vomica, *Sauv.* sp. 21.

This sometimes follows pneumonia, though the case is not frequent. The symptoms of it so much resemble the phthisis, that it can most properly be treated of under that head.

187 EMPYEMA.

This is another consequence of a pneumonia terminating unfavourably, and is occasioned by the effusion of a quantity of purulent mattter into the cavity of the thorax, producing a lingering and painful disorder, very often incurable.

Description. The first sign of an empyema is a cessation of the pain in the breast, which before was continual: this is followed by a sensation of weight on the diaphragm; and a fluctuation of matter, sometimes making a noise that may be heard by the bystanders: the acute fever is changed into a hectic, with an exacerbation at night: a continual and troublesome dry cough remains. The respiration is exceedingly difficult, because the lungs are prevented by the matter from fully expanding themselves. The patient can lie easily on that side where the matter is effused, but not on the other, because then the weight of the matter on the mediastinum produces uneasiness. The more the hectic heat is augmented, the more is the body emaciated, and its strength decayed. In some there is danger of suffocation when they stoop down, which goes off when they alter that posture of the body; and in some there is a purulent spitting.—These symptoms are accompanied with great anxiety, palpitations of the heart, and faintings. Sometimes the patients have a sensation like a hot vapour ascending from the cavity of the thorax to their mouth. Others, in a more advanced state of the disease, have a putrid taste in the mouth. At the same time, profuse night-sweats waste the body, and greatly weaken the patient. The face at first grows red on that side where the matter lies, at last the Hippocratic face comes on, and the eyes become hollow. The pulse, especially on the affected side, is quick, but more frequently intermitting. Sometimes the nails are crooked, and pustules appear on the thorax; and frequently, according to the testimony of Hippocrates, the feet swell, and, on the affected side of the breast, there is an inflation and swelling of the skin.

Empyema.

Causes, &c. An empyema may arise either from the bursting of a vomica of the lungs, or from a suppuration taking place after the inflammatory stage of the pneumonia; or sometimes from a suppuration in the case of a quinsy, when the inflammation had extended to the aspera arteria, from whence arises a kind of bloody spittle, and the patients are afflicted with an empyema, unless they die on the 7th day of the disease, according to the observation of Hippocrates. It may arise also from external violence, as wounds of the thorax, &c. blood extravasated, corrupted, or changed into pus. Like the vomica, it is a rare distemper, but may attack all those subject to pneumonia.

Prognosis. Very few recover after an empyema has been once formed, especially if the operation of paracentesis be neglected. After this operation is performed, if a great quantity of bloody fetid pus be discharged, if the fever continue, and if the patient spit up a purulent, pale, frothy, livid, or green matter, with a decay of strength, there is no hope: But when a small quantity of pus, of a white colour, not very fetid, is discharged; when the fever and thirst presently cease, the appetite returns, and fæces of a good consistence are discharged, the strength also returning in some degree; there is then hope of a perfect recovery. If the matter be not dried up in seven weeks time, the disease readily changes to a fistulous ulcer which is very difficult to cure. An empyema affecting both sides of the thorax is more dangerous than that which affects only one.

Cure. This consists in evacuating the purulent matter contained in the cavity of the thorax, which is best done by the operation of paracentesis. See the article SURGERY. Afterwards the ulcer is to be treated with abstergent and consolidating medicines, and the same internal ones are to be given as in a PHTHISIS.

Gen. XIII. CARDITIS. 18

Inflammation of the HEART.

Carditis, *Sauv.* gen. 111. *Vog.* 54.
Pericarditis, *Vog.* 53.
Carditis spontanea, *Sauv.* sp. 1. *Senac.* Traité de Cœur, lib. iv. chap. 7. *Meckel*, Mem. de Berlin, 1756.
Erysipelas pulmonis, *Lomm.* Observ. lib. ii.

Description. This disease is attended with all the symptoms of pneumonia, but in a higher degree; it is besides said to be accompanied with hydrophobic symptoms, fainting, palpitation of the heart, a seeming madness, a sunk and irregular pulse, watery eyes, and a dejected countenance, with a dry and black tongue. On dissection, the heart and pericardium are found very much inflamed, and even ulcerated, with many polypous concretions.

Causes, &c. The same as in the pneumonia.

Prognosis. In the carditis the prognosis is more unfavourable than in the pneumonia; and indeed, unless the disease very quickly terminates, it must prove fatal, on account of the constant and violent motion of the heart, which exasperates the inflammation, and increases all the symptoms.

Cure. Here bleeding is necessary in as great a

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degree as the patient can possibly bear, together with blistering, and the antiphlogistic regimen likewise carried to a greater height than in the pneumonia; but the general method is the same as in other inflammatory diseases.

189 Genus XIV. PERITONITIS.
Inflammation of the PERITONÆUM.

Sp. I. *Inflammation of the* PERITONÆUM properly so called.

Peritonitis, *Vog.* 62. *Lieutad.* Hist. anat. med. lib. i. obs. 3. *Raygerus* apud eund. lib. i.. obs. 341. *Morgagn.* de sed. LVII. 20.

190 Sp. II. *Inflammation of the* PERITONÆUM extended over the *Omentum.*

Epiploitis, *Sauv.* gen. 106. *Sag.* gen. 308.
Omentitis, *Vog.* 61.
Omenti inflammatio, *Boerh.* 958. et Ill. *Van Swieten*, Comm. *Stork.* An. Med. I. 132. *Hulme* on the puerperal fever.

191 Sp. III. *Inflammation of the* PERITONÆUM stretched over the *Mesentery.*

Mesenteritis, *Vog.* 60.
Enteritis mesenterica, *Sauv.* sp. 4.

192 Genus XV. GASTRITIS.
Inflammation of the STOMACH.

A. GASTRITIS PHLEGMONODÆA, or the *genuine Gastritis.*

Gastritis legitima, *Sauv.* sp. 1. *Eller.* de cogn. et cur. morb. sect. xii. *Haller.* obs. 14. hist. 3.
193 . *Lieut.* Hist. anat. Med. lib. 1. 74.
Gastritis erysipelatosa, *Sauv.* sp. 4.
Cardialgia inflammatoria, *Sauv.* sp. 13. *Tralles*, de opio sect. ii. p. 231.

THESE diseases Dr Cullen has thought proper to consider all under the general head GASTRITIS, as there are no certain signs by which they can be distinguished from each other, and the method of cure must be the same in all.

Description. The inflammation of the stomach is attended with great heat and pain in the epigastric region, extreme anxiety, and almost continual and painful hiccough, with a most painful vomiting of every thing taken into the stomach. Sometimes a temporary madness ensues; and there is an instance in the Edinburgh Medical Essays of the disorder being attended with an hydrophobia. The pulse is generally more sunk than in other inflammations, and the fever inclines to the nature of a typhus. The disorder is commonly of the remitting kind, and during the remissions the pulse frequently intermits. During the height of the disease, a mortal phrenzy frequently supervenes. The disease terminates on the fourth, seventh, or ninth day, or from the eleventh to the fifteenth; and is more apt to end in a gangrene than pneumonic inflammations, and more frequently in a scirrhus than in an abscess.

Causes, &c. The inflammation of the stomach may arise from any acrid substance taken into it; from a vehement passion; too large draughts of cold liquor, especially when the person is very hot; from a surfeit; a stoppage of perspiration; repulsion of the gout; inflammations of the neighbouring viscera; or from external injuries, such as wounds, contusions, &c.— It affects chiefly those of a plethoric habit and hot bilious constitution.

Gastritis.

Prognosis. This disease is always very dangerous, and the prognosis doubtful, which also must always be in proportion to the severity of the symptoms. A cessation of pain, coldness about the præcordia, great debility, with a languid and intermitting pulse, with an abatement of the hiccough, denote a gangrene and speedy death. From the sensibility of the stomach also, and its great connection with the rest of the system, it must be obvious, that an inflammation of it, by whatever causes produced, may be attended with fatal consequences; particularly, by the great debility it produces, it may prove suddenly fatal, without running through the usual course of inflammations.—Its tendency to admit of resolution may be known by its having arisen from no violent cause, by the moderate state of the symptoms, and by a gradual remission of these symptoms in the course of the first or at most of the second week of the disease. The tendency to gangrene may be suspected from the symptoms continuing with unremitting violence notwithstanding the use of proper remedies, and a gangrene already begun may be known by the symptoms abovementioned, particularly great debility and sudden cessation of pain. The tendency to suppuration may be known by the symptoms continuing but in a moderate degree for more than one or two weeks, and by a considerable remission of the pain while a sense of weight and anxiety still remain. When an abscess has been formed, the frequency of the pulse is first abated: but soon after it increases, with frequent cold shivering, and an exacerbation in the afternoon and evening; followed by night-sweats, and other symptoms of hectic fever. These at length prove fatal, unless the abscess open into the cavity of the stomach, the pus be evacuated by vomiting, and the ulcer soon healed.

Cure. It appears from dissections, that the stomach may very often be inflamed when the characteristic marks of it have not appeared; and therefore we are often exposed to much uncertainty in the cure. But when we have sufficient evidence that a state of active inflammation has taken place in the stomach, the principal object to be aimed at is to obtain a resolution. Before, however, this can be accomplished, it will often be necessary to employ measures with the view of obviating urgent symptoms. When the symptoms appear in the manner above described, the cure is to be attempted by large and repeated bleedings employed early in the disease; and from these we are not to be deterred by the weakness of the pulse, for it will commonly become fuller and softer after the operation. A blister ought also to be applied to the region of the stomach; and the cure will be assisted by fomentations of the whole abdomen, and by frequent emollient and laxative glysters. The irritability of the stomach in this disease will admit of no medicines being thrown into it; and if any can be supposed necessary, they must be exhibited in glysters. Diluting drinks may be tried; but they must be of the very mildest kind, and given in very small quantities at a time. Opiates, in whatever manner exhibited, cannot be retained in the stomach during the first days of the disease; but when the violence of the disease shall have abated, and when the pain and vomiting

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vomiting recur at intervals only, opiates given in glysters may frequently be employed with advantage; and after bleeding and blisters no remedy is more effectual either in allaying the pain or vomiting. As soon as the stomach will retain any laxative, gentle refrigerant cathartics, taken by the mouth, such as the soda phosphorata, soda tartarisata, or the like, are productive of great benefit. A tendency to gangrene in this disease is to be obviated only by the means just now mentioned; and when it does actually suppervene, it admits of no remedy. A tendency to supuration is to be obviated by the same means employed early in the disease. After a certain period it cannot be prevented by any means whatever; and, when actually begun, must be left to nature; the only thing that can be done by art being to avoid all irritation.

194 B. *Gastritis Erysipelatosa*, or the *Erysipelatous Gastritis*.

Description. This species of inflammation takes place in the stomach much more frequently than the former. From dissections it appears that the stomach has been often affected with inflammation, when neither pain nor fever had given any notice of it; and such is justly looked upon to have been of the erysipelatous kind. This kind of inflammation also is especially to be expected from acrimony of any kind applied to the stomach; and would certainly occur much more frequently, were not the interior surface of this organ commonly defended by mucus exfuding in large quantity from the numerous follicles placed immediately under the villous coat. On many occasions, however, the exsudation of mucus is prevented, or the liquid poured out is of a less viscid kind, so as to be less fitted to defend the subjacent nerves; and it is in such cases that acrid matters may readily produce an erysipelatous affection of the stomach.

In many cases, however, this kind of inflammation cannot be discovered, as it takes place without pain, pyrexia, or vomiting: but in some cases it may; namely, when it spreads into the œsophagus, and appears on the pharynx and on the whole internal surface of the mouth. When therefore an erysipelatous inflammation affects the mouth and fauces, and there shall be at the same time in the stomach an unusual sensibility to all acrids, and also a frequent vomiting there can be little doubt of the stomach's being affected in the same manner. Even when no inflammation appears in the fauces, if some degree of pain be felt in the stomach, if there be a want of appetite, an anxiety and frequent vomiting, an unusual sensibility with regard to acrids, some thirst, and frequency of pulse, there will then be room to suspect an inflammation in the stomach; and such symptoms, after some time, have been known to discover their cause by the inflammation rising to the fauces or mouth. Inflammation of this kind is often disposed to pass from one place to another on the same surface, and, in doing so, to leave the place it had at first occupied. Such an inflammation has been known to spread successively along the whole tract of the alimentary canal; occasioning, when in the intestines, diarrhœa, and in the stomach vomitings; the diarrhœa ceasing when the vomitings came on, and the vomitings on the coming on of the diarrhœa.

Causes, &c. An erysipelatous inflammation may arise from acrid matters taken into the stomach; or from some internal causes not yet well known. It frequently occurs in putrid diseases, and in those recovering from fevers.

Gastritis.

Cure. When the disease is occasioned by acrid matters taken internally, and these may be supposed still present in the stomach, they are to be washed out by drinking a large quantity of warm and mild medicines, and exciting vomiting. At the same time, if the nature of the acrimony and its proper corrector be known, this should be thrown in; or if a specific corrector be not known, some general demulcents should be employed.

These measures, however, are more suited to prevent than to cure inflammation after it has taken place. When this last may be supposed to have happened, if it be attended with a sense of heat, with pain and pyrexia, according to the degree of these symptoms, the measures proposed for the cure of the other kind are to be more or less employed. When an erysipelatous inflammation of the stomach has arisen from internal causes, if pain and pyrexia occur, bleeding may be employed in persons not otherwise weakened; but in case of its occurring in putrid diseases, or where the patients are already debilitated, bleeding is inadmissible; all that can be done being to avoid irritation, and only throwing into the stomach what quantity of acids and acescent aliments it shall be found able to bear. In some conditions of the body in which this disease is apt to occur, the Peruvian bark and bitters may seem to be indicated; but an erysipelatous state of the stomach will seldom allow them to be used.

Genus XVI. ENTERITIS, 561

Inflammation of the *Intestines*.

Enteritis, *Sauv.*. gen. 105. *Lin.* 29. *Vog.* 57. *Sag.* gen. 307.
Intestinorum inflammatio, *Boerh.* 959.
Febris intestinorum inflammatoria ex mesenterio, *Hoffm.* II. 170.

Sp. I. *Enteritis Phlegmonodæa*, or the *Acute Enteritis* 196

Enteritis iliaca, *Sauv.* sp. 1.
Enteritis colica, *Sauv.* sp. 2. *Boerh.* 963.

Description. This disease shows itself by a fixed pain in the abdomen, attended with fever, vomiting, and costiveness. The pain is often felt in different parts of the abdomen, but more frequently spreads over the whole, and is particularly violent about the navel.

Causes, &c. Inflammations of the intestines may arise from the same causes as those of the stomach; though commonly the former will more readily occur from cold applied to the lower extremities, or to the belly itself. It is also found supervening on the spasmodic colic, incarcerated hernia, and volvulus.

Prognosis. Inflammations of the intestines have the same terminations with those of the stomach, and the prognosis in both cases is much the same.

Cure. The cure of enteritis is in general the same with that of gastritis: but in this disease there is commonly more opportunity for the introduction of liquids, of acid, acescent, and other cooling remedies, and even of laxatives; but as a vomiting frequently attends the enteritis, care must be taken not to excite that vomiting by the quantity or quality of any thing thrown

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thrown into the ſtomach. With regard to the ſuppuration and gangrene of the inteſtines following the enteritis, the obſervations, made reſpecting theſe terminations of gaſtritis are equally applicable in this diſeaſe.

197 Sp. II. *Enteritis Erysipelatosa*, or *Eryſipelatous Enteritis*.

Concerning this nothing farther can be ſaid, than what hath been already delivered concerning the gaſtritis.

198 Genus XVII. HEPATITIS.
Inflammation of the Liver.

Hepatitis, *Sauv.* gen. 113. *Lin.* 35. *Vog.* 58. *Sag.* gen. 312. *Boerh.* 914. *Hoffm.* II. 14. *Junck.* 66.

Deſcription. The inflammation of the liver is thought to be of two kinds, acute and chronic; but the latter very often does not diſcover itſelf except by an abſceſs found in the liver after death, and which is ſuppoſed to have been occaſioned by ſome degree of inflammation; for this reaſon the chronic inflammation often eſcapes obſervation, and we ſhall here only treat of the acute hepatitis.

The acute hepatitis is attended with conſiderable fever; a frequent, ſtrong, and hard pulſe; high coloured urine; an acute pain in the right hypochondrium, increaſed by preſſing upon the part. The pain is very often in ſuch a part of the ſide as to make it appear like a pleuriſy; and frequently, like that, is increaſed on inſpiration. The diſeaſe is alſo commonly attended with a cough, which is generally dry, but ſometimes moiſt; and when the pain thus reſembles a pleuriſy, the patient cannot lie eaſily except upon the ſide affected. The pain is frequently extended to the clavicle, and to the top of the ſhoulder; and is attended ſometimes with hiccough, and ſometimes with vomiting. Some have added jaundice, or a yellowneſs of the eyes, to the ſymptoms of this diſtemper; but experience ſhows that it has often occurred without any ſuch ſymptom.

When hepatitis is of the chronic kind, depending more on the accumulation and effuſion in the liver than in an increaſed action of its ſmall veſſels, the patient complains rather of a ſenſe of weight than of pain; and the fever is by no means either acute, or conſtant: but it often returns in paroxyſms ſomewhat reſembling the attacks of an intermittent. This diſeaſe is very ſlow in its progreſs, frequently continuing for many months, and at laſt terminating in a very conſiderable ſuppuration. In moſt caſes however, it may be diſcovered by careful examination of the region of the liver externally. By this means, a conſiderable enlargement of that viſcus may in general be diſcovered.

Cauſes, &c. The remote cauſes of hepatitis are not always to be diſcerned, and many have been aſſigned on a very uncertain foundation. It has been ſuppoſed that the diſeaſe may be an affection either of the extremities of the hepatic artery, or thoſe of the vena portarum; and the ſuppoſition is by no means improbable. The opinion, however, moſt commonly adopted is, that the acute hepatitis is an affection of the external membrane of the liver, and the chronic kind an affection of the parenchyma of that viſcus. The acute diſeaſe may be ſeated either on the convex or concave ſurface of the liver; and in the former caſe a more pungent pain and hiccough may be produced, and the reſpiration is more conſiderably affected. In the latter there occurs leſs pain; and a vomiting is produced, commonly by ſome inflammation communicated to the ſtomach. The inflammation on the concave ſurface of the liver may be readily communicated to the gall-bladder and biliary ducts: and this, perhaps, is the only caſe of idiopathic hepatitis attended with jaundice.

Hepatitis.

Prognoſis. The inflammation of the liver, like others, may end by reſolution, ſuppuration, or gangrene; and the tendency to the one or to the other of thoſe events may be known from what has been already mentioned concerning the prognoſis in gaſtritis. The reſolution of hepatitis is often the conſequence of or is attended with, evacuations of different kinds. A hæmorrhage, ſometimes from the noſe, and ſometimes from the hæmorrhoidal veſſels, gives a ſolution of the diſeaſe. Sometimes the ſame thing is accompliſhed by a bilious diarrhœa; and ſometimes the reſolution is attended with ſweating, and an evacuation of urine depoſiting a copious ſediment. Sometimes it may be cured by an eryſipelas appearing in ſome external part. When the diſeaſe has ended in ſuppuration, the pus collected may be diſcharged by the biliary ducts; or, if the ſuppurated part does not adhere any where cloſely to the neighbouring parts, it may be diſcharged into the cavity of the abdomen: but if, during the firſt ſtate of inflammation, the affected part of the liver ſhall have formed a cloſe adheſion to ſome of the neighbouring parts, the diſcharge after ſuppuration may be various, according to the different ſeat of the abſceſs. When ſeated on the convex part of the liver, if the adheſion be to the peritonæum lining the common teguments, the pus may make its way through theſe, and be diſcharged outwardly: or if the adheſion ſhall have been to the diaphragm, the pus may penetrate through this, and into the cavity of the lungs; from whence it may be diſcharged by coughing. When the abſceſs is ſeated on the concave part of the liver, in conſequence of adheſions, the pus may be diſcharged into the ſtomach or inteſtines; and into theſe laſt, either directly, or by the intervention of the biliary ducts. Upon a conſideration of all theſe different circumſtances therefore, together with the general principles of inflammation, muſt the prognoſis of this diſeaſe be eſtabliſhed.

Cure. For the cure of hepatitis, we muſt have recourſe to the general means of removing other inflammatory diſorders. Bleeding is to be uſed according to the degree of fever and pain. Bliſters are to be applied: fomentations of the external parts, emollient glyſters, gentle laxatives, diluents and refrigerants, are alſo uſeful. The cure, however, particularly in warm climates, where the diſeaſe is much more common than it is in Britain, is chiefly truſted to mercury. Not only in caſes of the chronic kind, but in acute hepatitis alſo, after an attempt has been made to alleviate the urgent ſymptoms by bleeding and bliſtering, recourſe is immediately had to this powerful mineral. It is employed by different practitioners, and in different caſes, under various forms. Some are very

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very fond of the use of calomel. But the preference is in general given, and perhaps with justice, to friction with mercurial ointment over the region of the liver. But under whatever form it may be employed, it is necessary that it should be introduced to such an extent as to keep the patient on the verge of salivation for some length of time; the duration being regulated by the circumstances of the case.

From the liberal use of mercury, there can be no doubt that a successful resolution has been obtained in many cases, which would otherwise have infallibly terminated in suppuration. But notwithstanding the most careful employment of it in some cases, suppuration will ensue; and then it is very doubtful whether any benefit will be derived from the continuance of it. But when a suppuration has been formed, and the abscess points outwardly, the part must be opened, the pus evacuated, and the ulcer healed according to the ordinary methods in use for healing abscesses and ulcers in other parts.

199 Genus XVIII. SPLENITIS.

Inflammation of the SPLEEN.

Splenitis, *Sauv.* gen. 114. *Lin.* 36. *Vog.* 59. *Junck.* 67. *Sag.* gen. 313.
Lienis inflammatio, *Boerh.* 958. & *Van Swieten.* Comm.
Splenitis phlegmonodæa, *Sauv.* sp. 1. *Forest*, l. xx. obs. 5. 6. *De Haen*, apud *Van Swieten*, p. 958.
Pleuritis splenica, *Sauv.* sp. 19.
Splenalgia suppuratoria, *Sauv.* sp. 3.

Description. This disease, according to *Juncker*, comes on with a remarkable shivering succeeded by a most intense heat and very great thirst; a pain and tumor are perceived in the left hypochondrium, and the paroxysms for the most part assume a quartan form. When the patients expose themselves for a little to the free air, their extremities immediately grow very cold. If an hæmorrhagy happens, the blood flows out of the left nostril. The other symptoms are the same with those of the hepatitis. Like the liver, the spleen often is also subject to a chronic inflammation, which often happens after agues, and is called the *ague cake*, though that name is also frequently given to a scirrhous tumour of the liver succeeding intermittents.

Causes, &c. The causes of this distemper are in general the same with those of other inflammatory disorders; but those which determine the inflammation to that particular part more than another, are very much unknown. It attacks persons of a very plethoric and sanguine habit of body rather than others.

Prognosis. What has been said of the inflammation of the liver applies also to that of the spleen, tho' the latter is less dangerous than the former. Here also a vomiting of black matter, which in other acute diseases is such a fatal omen, sometimes proves critical, according to the testimony of Juncker. Sometimes the hæmorrhoids prove critical; but very often the inflammation terminates by scirrhus.

Cure. This is not at all different from what has been already laid down concerning the hepatitis.

200 Genus XIX. NEPHRITIS.

Inflammation of the KIDNEYS.

Nephritis, *Sauv.* gen. 115. *Lin.* 37. *Vog.* 65. *Sag.* gen. 314.
Nephritis vera, *Sauv.* sp. 1.

Nephritis.

Description. The nephritis has the same symptoms in common with other inflammations; but its distinguishing mark is the pain in the region of the kidney, which is sometimes obtuse, but more frequently pungent. The pain is not increased by the motion of the trunk of the body so much as a pain of the rheumatic kind affecting the same region. It may also frequently be distinguished by its shooting along the course of the ureter, and it is often attended with a drawing up of the testicle, and a numbness of the limb on the side affected; though indeed these symptoms most commonly attend the inflammation arising from a calculus in the kidney or ureter. The disease is also attended with frequent vomiting, and often with costiveness and colic pains. The urine is most commonly of a deep red colour, and is voided frequently and in a small quantity at a time. In more violent cases the urine is commonly colourless.

Causes, &c. The remote causes of this disease may be various; as external contusion, violent or long-continued riding; strains of the muscles of the back incumbent on the kidneys; various acrids in the course of circulation conveyed to the kidneys; and perhaps some other internal causes not yet well known: the most frequent is that of calculous matter obstructing the *tubuli uriniferi*, or calculi formed in the pelvis of the kidneys, and either sticking there or falling into the ureter.

Prognosis. This is not different from that of other inflammatory diseases.

Cure. When any of those causes operating as inducing the inflammation still continue to act, the first object in the cure must be the removal of these: but the principal intention to be had in view, is the resolution of the inflammation which has already taken place. But when, notwithstanding efforts for this purpose, the disease terminates in suppuration, it must be the endeavour of the practitioner to promote the discharge of purulent matter, and the healing of the ulceration in the kidney.

These different objects are principally accomplished by bleeding, external fomentation, frequent emollient glysters, antiphlogistic purgatives, and by the free use of mild and demulcent liquids. The use of blisters is scarce admissible, or at least will require great care to avoid any considerable absorption of the cantharides.

The other species of nephritis enumerated by authors are only symptomatic.

Genus XX. CYSTITIS. 201

Inflammation of the BLADDER.

Cystitis, *Sauv.* gen. 108. *Lin.* 31. *Vog.* 66. *Sag.* gen. 309.
Inflammatio vesicæ, *Hoffm.* II. 157.

The CYSTITIS from *Internal Causes*. 202

Cystitis spontanea, *Sauv.* sp. 1.

The CYSTITIS from *External Causes*. 203

Cystitis a cantharidibus, *Sauv.* sp. 2.
Cystitis traumatica, *Sauv.* sp. 3.

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The inflammation of the bladder from internal causes is a very rare distemper; and when it does at any time occur, is to be cured in the same manner with other inflammations, avoiding only the use of cantharides. When the disease arises from the internal use of these flies, camphor is recommended, besides other cooling medicines, and particularly cooling and emollient glysters.

204 Genus XXI. HYSTERITIS.

Inflammation of the UTERUS.

Hysteritis, *Lin.* 38. *Vog.* 63.
Metritis, *Sauv.* gen. 107. *Sag.* gen. 315.
Inflammatio et febris uterina, *Hoffm.* II. 156.

Description. This disease is often confounded with that called the *puerperal* or *child-bed fever;* but is essentially distinct from it, as will be shown in its proper place. The inflammation of the uterus is often apt to terminate by gangrene: there is a pain in the head, with delirium; and the uterine region is so exceedingly tender, that it cannot bear the most gentle pressure without intolerable pain. When the *fundus uteri* is inflamed, there is great heat, throbbing, and pain, above the pubes; if its posterior part, the pain is more confined to the loins and rectum, with a tenesmus; if its anterior part, it shoots from thence towards the neck of the bladder, and is attended with a frequent irritation to make water, which is voided with difficulty; and if its sides or the ovaria are affected, the pains will then dart into the inside of the thighs.

Causes, &c. Inflammation of the uterus, and indeed of the rest of the abdominal viscera, are very apt to take place in child-bed women; the reason of which seems to be the sudden change produced in the habit, and an alteration in the course of the circulating blood by the contraction of the uterus after delivery. The pressure of the gravid uterus being suddenly taken off from the *aorta descendens* after delivery, the resistance to the impulse of the blood passing through all the vessels derived from it, and distributed to the contiguous viscera, will be considerably lessened: it will therefore rush into those vessels with a force superior to their resistance; and, by putting them violently on the stretch, may occasion pain, inflammation, and fever. This contraction of the uterus also renders its vessels impervious to the blood which had freely passed through them for the service of the child during pregnancy; and consequently a much larger quantity will be thrown upon the contiguous parts, which will still add to their distension, and increase their tendency to inflammation.

Prognosis. An inflammation of the uterus generally may be expected to produce an obstruction of the lochia; but the fever produced seldom proves fatal, unless the inflammation be violent, and end in a gangrene.

Cure. This is to be attempted by the same general means already recommended, and the management of this disorder entirely coincides with that of the puerperal fever.

205 Genus XXII. RHEUMATISMUS.

The RHEUMATISM.

Rheumatismus, *Sauv.* gen. 185. *Lin.* 62. *Vog.* 138. *Boerh.* 1400. *Junck.* 19.
Dolores rheumatici et arthritici, *Hoffm.* II. 317.
Myositis, *Sag.* gen. 301.

Rheumatismus.

The *Acute* RHEUMATISM.

Rheumatismus acutus, *Sauv.* sp. 1.
Rheumatismus vulgaris, *Sauv.* sp. 2.

A. The LUMBAGO, or *Rheumatism in the muscles of the Loins.* 206

Lumbago rheumatica, *Sauv.* gen. 212. *Sag.* p. 1.
Nephralgia rheumatica, *Sauv.* sp. 4.

B. The SCIATICA, *Ischias*, or *Hip-Gout.* 207

Ischias rheumaticum, *Sauv.* 213. sp. 10.

C. The *Bastard* PLEURISY, or *Rheumatism in the muscles of the Thorax.* 208

Pleurodyne rheumatica, *Sauv.* gen. 148. sp. 3.
Pleuritis spuria, *Boerh.* 878.

The other species, which are very numerous, are all symptomatic; as,
Lumbago plethorica, *Sauv.* sp. 3.
Ischias sanguineum, *Sauv.* sp. 2.
Pleurodyne plethorica, *Sauv.* sp. 1.
Rheumatismus hystericus, *Sauv.* sp. 7.
Ischias hystericum, *Sauv.* sp. 3.
Pleurodyne hysterica, *Sauv.* sp. 6.
Rheumatismus saltatorius, *Sauv.* sp. 8.
Pleurodyne flatulenta, *Sauv.* sp. 4.
Pleurodyne a spasmate, *Sauv.* sp. 9.
Rheumatismus scorbuticus, *Sauv.* sp. 4.
Lumbago scorbutica, *Sauv.* sp. 5.
Pleurodyne scorbutica, *Sauv.* sp. 11.
Ischias syphiliticum, *Sauv.* sp. 7.
Pleurodyne venerea, *Sauv.* sp. 5.
Lumbago sympathica, *Sauv.* sp. 13.
a mesenterii glandulis induratis
a pancreate tumido, purulento, scirrhoso, putri,
ab induratis pyloro, vena cava, pancreate
a rene scirrhoso, putrefacto
ab abscessu circa venæ cavæ bifurcationem
a vermibus intra renes.
Lumbago a saburra, *Sauv.* sp. 8.
Pleurodyne a cacochylia, *Sauv.* sp. 7.
Rheumatismus salatorius verminosus, *Sauv.* sp. 8.
Ischias verminosum, *Sauv.* sp. 8.
Pleurodyne verminosa, *Sauv.* sp. 2.
Rheumatismus metallicus, *Sauv.* sp. 10.
Lumbago a hydrothorace, *Sauv.* sp. 14.
Lumbago pseudoischuria, *Sauv.* sp. 16.
Pleurodyne a rupto œsophago, *Sauv.* sp. 20.
Pleurodyne rachitica, *Sauv.* sp. 13.
Ischias a sparganosi, *Sauv.* sp. 5.
Pleurodyne catarrhalis, *Sauv.* sp. 14.
Rheumatismus necroseos, *Sauv.* sp. 14.
Rheumatismus dorsalis, *Sauv.* sp. 11.
Lumbago a satyriasi, *Sauv.* sp. 15.
Rheumatismus febricosus, *Sauv.* sp. 9.
Lumbago febrilis, *Sauv.* sp. 4.
&c. &c.

Description. The rheumatism is particularly distinguished by pains affecting the joints, and for the most part the joints alone; but sometimes also the muscular parts. Very often they shoot along the course of the muscles

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muſcles from one joint to another, and are always much increaſed by the action of the muſcles belonging to the joint or of joints affected. The larger joints are thoſe moſt frequently affected, ſuch as the hip-joint and knees of the lower extremities, and the ſhoulders and elbows of the upper ones. The ancles and wriſts are al o frequently affected; but the ſmaller joints, ſuch as thoſe of the toes or fingers, ſeldom ſuffer. Sometimes the diſeaſe is confined to one part of the body, yet very frequently it affects many parts of it; and then it begins with a cold ſtage, which is immediately ſucceeded by the other ſymptoms of pyrexia, and particularly by a frequent, full, and hard pulſe. Sometimes the pyrexia is formed before any pains are perceived; but more commonly pains are felt in particular parts before any ſymptoms of pyrexia occur. When no pyrexia is preſent, the pain may be confined to one joint only; but when any conſiderable pyrexia takes place, though the pain may chiefly be felt in one joint, yet it ſeldom happens that the pains do not affect ſeveral joints, often at the very ſame time, but for the moſt part ſhifting their place, and having abated in one joint they become more violent in another. They do not commonly remain long in the ſame joint, but frequently ſhift from one to another, and ſometimes return to joints formerly affected; and in this manner the diſeaſe often continues for a long time. The fever attending theſe pains has an exacerbation every evening, and is moſt conſiderable during the night, when the pains alſo become more violent; and it is at the ſame time that the pains ſhift their place from one joint to another. Theſe ſeem to be alſo increaſed during the night by the body being covered more cloſely, and kept warmer.

A joint, after having been for ſome time affected with pain, commonly becomes alſo affected with ſome ſwelling and redneſs, which is painful to the touch. It ſeldom happens that a ſwelling coming on does not take off the pain entirely, or ſecure the joint againſt a return of it. This diſeaſe s commonly attended with more or leſs ſweating, which occurs early, but is ſeldom free or copious, and ſeldom either relieves from the pains or proves critical. The urine is high coloured, and in the beginning without ſediment. This, however, does not prove entirely critical, for the diſeaſe often continues long after ſuch a ſediment has appeared in the urine. The blood is always ſizy. The acute rheumatiſm differs from all other inflammatory diſeaſes, in not being liable to terminate in ſuppuration: this almoſt never happens; but the diſeaſe ſometimes produces effuſions of a tranſparent gelatinous fluid into the ſheathes of the tendons: but if theſe effuſions be frequent, it is certain that the liquor muſt very frequently be abſorbed; for it very ſeldom happens, that conſiderable or permanent tumors have been produced, or ſuch as required to be opened and to have the contained fluid evacuated. Such tumors, however, have ſometimes occurred, and the opening made in them has produced ulcers very difficult to heal.

Sometimes the rheumatiſm will continue for ſeveral weeks; but it ſeldom proves fatal, and it is rare that the pyrexia continues to be conſiderable for more than two or three weeks. While the pyrexia abates in its violence, if the pains of the joints continue, they are leſs violent; more limited in their place, being confined commonly to one or a few joints only; and are leſs ready to change their place.

Rheumatiſmus.

It is often a very difficult matter to diſtinguiſh rheumatiſm from gout; but in rheumatiſm there in general occurs much leſs affection of the ſtomach; it affects chiefly the larger joints, and ſeveral of theſe are often affected with ſevere pain at the ſame time: it occurs at an earlier period of life than gout; it is not obſerved to be hereditary; and it can in general be traced to ſome obvious exciting cauſe, particularly to the action of cold.

Cauſes, &c. This diſeaſe is frequent in cold, and more uncommon in warm, climates. It appears moſt frequently in autumn and ſpring; leſs frequently in winter, while the froſt is conſtant; and very ſeldom during the heat of ſummer. It may, however, occur at any ſeaſon, if viciſſitudes of heat and cold be for the time frequent. For the moſt part, the acute rheumatiſm ariſes from the application of cold to the body when unuſually warm; or when the cold is applied to one part of the body, w.ilſt the other parts are kept warm; or laſtly, when the application of the cold is long continued, as when moiſt or wet clothes are applied to any part of the body.—Theſe cauſes may affect perſons of all ages; but the reheumatiſm ſeldom appears either in very young or in elderly perſons, and moſt commonly occurs from the age of puberty to that of 35. Theſe cauſes may alſo affect perſons of any conſtitution, but they moſt commonly affect thoſe of a ſanguine temperament.

With reſpect to the proximate cauſe of rheumatiſm, there have been various opinions. It has been imputed to a peculiar acrimony; of which, however, there is no evidence; and the conſideration of the remote cauſes, the ſymptoms, and cure, render it very improbable. A diſeaſe of a rheumatic nature, however, may be occaſioned by an acrid matter applied to the nerves, as is evident from the tooth-ach, a rheumatic affection generally ariſing from a carious tooth. Pains ariſing from deep-ſeated ſuppurations may alſo reſemble the rheumatiſm; and many caſes have occurred in which ſuch ſuppurations occaſioned pains reſembling the lumbago and iſchias; but from what hath been already ſaid, it ſeems improbable that ever any rheumatic caſe ſhould end in ſuppuration.

The proximate cauſe of rheumatiſm hath by many been ſuppoſed to be a lentor in the fluids obſtructing the veſſels of the part; but in the former part of this treatiſe, ſufficient reaſons have been already laid down for rejecting the doctrine of lentor. While we cannot therefore find either evidence or reaſon for ſuppoſing that the rheumatiſm depends on any change in the ſtate of the fluids, we muſt conclude that the proximate cauſe of it is the ſame with that of other inflammations not depending upon a direct ſtimulus.

In the caſe of rheumatiſm, it is ſuppoſed that the moſt common remote cauſe of it, that is, cold applied, operates eſpecially on the veſſels of the joints, theſe being leſs covered by a cellular texture than thoſe of the intermediate parts of the limbs. It is farther ſuppoſed, that the application of cold produces a conſtriction of the extreme veſſels, and at the ſame time an increaſe of tone or phlogiſtic diatheſis in the courſe of them, from which ariſes an increaſed impetus of the

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the blood, and at the ſame time a reſiſtance to the free paſſage of it, and conſequently inflammations and pain. It is alſo ſuppoſed, that the reſiſtance formed, excites the *vis medicatrix* to a further increaſe of the impetus of the blood; and to ſupport this, a cold ſtage ariſes, a ſpaſm is formed, and a pyrexia and phlogiſtic diatheſis are produced in the whole ſyſtem.

Hence the cauſe of rheumatiſm appears to be exactly analogous to that of inflammations depending on an increaſed afflux of blood to a part while it is expoſed to the action of cold. But there ſeems to be further in this diſeaſe ſome peculiar affection of the muſcular fibres. Theſe ſeem to be under ſome degree of rigidity; and therefore leſs eaſily admit of motion, and are pained upon the exertions of it. This alſo ſeems to be the affection which gives opportunity to the propagation of pains from one joint to another, and which are moſt ſeverely felt in the extremities terminating in the joints, becauſe beyond theſe the oſcillations are not propagated. This affection of the muſcular fibres explains the manner in which ſtrains and ſpaſms produce rheumatic affections; and, on the whole, ſhows, that with an inflammatory affection of the ſanguiferous ſyſtem, there is alſo in rheumatiſm a peculiar affection of the muſcular fibres, which has a conſiderable ſhare in producing the phenomena of the diſeaſe. And it would even appear, that in what has commonly been called *acute rheumatiſm*, in contradiſtinction to the chronic, of which we are next to treat, there exiſts not only a ſtate of active inflammation in the affected parts, but alſo of peculiar irritability; and that this often remains after the inflammation is very much diminiſhed or has even entirely ceaſed. Hence a renewal of the inflammation and recurrence of the pain take place from very ſlight cauſes: and in the treatment o the diſeaſe both the ſtate of inflammation and irritability muſt be had in view.

Cure. for counteracting the ſtate of active inflammation, the chief aim of the practitioner muſt be to diminiſh the general impetus of the circulation, and the impetus at the part particularly affected. For counteracting the ſtate of irritability, he muſt endeavour to remove the diſpoſition to encreaſed action in the veſſels; to prevent the action of cauſes exciting painful ſenſations; and to obviate their influence on the part. The cure therefore requires, in the firſt place, an antiphlogiſtic regimen, and particularly a total abſtinence from animal-food, and from all fermented or ſpirituous liquors; ſubſtituting a mild vegetable or milk diet, and the plentiful uſe of ſoft diluting liquors. On this principle alſo, blood-letting is the chief remedy of acute rheumatiſm. The blood is to be drawn in large quantity; and the bleeding is to be repeated in proportion to the frequency, fulneſs, and hardneſs of the pulſe, and the violence of the pain. For the moſt part, large and repeated bleedings during the firſt days of the diſeaſe ſeem to be neceſſary, and accordingly have been very much employed: but to this ſome bounds are to be ſet; for very profuſe bleedings occaſion a ſlow recovery, and if not abſolutely effectual, are ready to produce a chronic rheumatiſm.

To avoid that debility of the ſyſtem which general bleedings are apt to occaſion, the urgent ſymptom of pain may be often relieved by topical bleedings; and when any ſwelling or redneſs have come upon a joint, the pain may very certainly be relieved by topical bleedings: but as the pain and continuance of the diſeaſe ſeem to depend more upon the phlogiſtic diatheſis of the whole ſyſtem than upon the affection of particular parts, ſo topical bleedings will not ſupply the place of the general bleedings propoſed above.

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To take off the phlogiſtic diatheſis prevailing in this diſeaſe, purging may be uſeful, if produced by medicines which do not ſtimulate the whole ſyſtem, as neutral ſalts, and other medicines which have a refrigerant power. Purging, however, is not ſo uſeful as bleeding in removing the phlogiſtic diatheſis; and when the diſeaſe has become general and violent, frequent ſtools are inconvenient, and even hurtful, by the motion and pain which they occaſion.

Next to blood-letting, nothing is of ſo much ſervice, both in alleviating the pains in this diſeaſe and in removing the phlogiſtic diatheſis, as the uſe of ſudorifics: and of all the medicines belonging to this claſs, what has commonly been known by the name of Dover's powder, a combination of powder, of ipecacuan and opium, is the moſt convenient and the moſt effectual. Copious ſweating, excited by this medicine, and ſupported for 10 or 12 hours by tepid diluents, ſuch as decoction of the woods, or the like, will in moſt inſtances produce a complete remiſſion of the pain: and by this practice, combined with blood-letting and proper regimen, the diſeaſe may often be entirely removed.

If, however, after complete intermiſſions from pain for ſome length of time have been obtained by theſe means, it be found that there is a great tendency to a return of the pains without any obvious cauſe, recourſe may be had with very great benefit to the uſe of the Peruvian bark. By the early uſe of this, where a complete intermiſſion from pain is obtained, the neceſſity of repeated blood-letting and ſweating is often ſuperſeded; but where a complete remiſſion cannot be obtained, it has been ſuſpected by ſome to be hurtful: and in theſe caſes, when blood-letting and ſudorifics have been puſhed as far as may be thought prudent without being productive of the deſired effect, very great benefit is often obtained from the uſe of calomel combined with opium, as recommended in the Edinburgh Medical Commentaries by Dr Hamilton of Lynn-regis

In this diſeaſe, external applications are of little ſervice. Fomentations in the beginning of the diſeaſe, rather aggravate than relieve the pains. The rubefacients and camphire are more effectual: but they, commonly only ſhift them from one part to another, and do not prove any cure of the general affection. Bliſtering may alſo be very effectual in removing the pain from a particular part; but will be of little uſe, except where the pains are much confined to one place.

ARTHRODYNIA, *or Chronic* Rheumatism. 209

Rheumatiſmus chronicus Auctorum.

Deſcription. When the pyrexia attending the acute rheumatiſm has ceaſed; when the ſwelling and redneſs of the joints are entirely gone, but pains ſtill continue to affect certain joints, which remain ſtiff, feel uneaſy upon

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upon motion, changes of weather, or in the night-time only, the diſeaſe is then called the *chronic rheumatiſm*, as it often continues for a very long time.

The limits between the acute and chronic rheumatiſms are not always exactly marked. When the pains are ſtill ready to ſhift their place; when they are eſpecially ſevere in the night-time; when, at the ſame time, they are attended with ſome degree of pyrexia, and with ſome ſwelling, and eſpecially ſome redneſs of the joints; the diſeaſe is to be conſidered as partaking of the nature of the acute rheumatiſm. But when there is no longer any degree of pyrexia remaining; when the pained joints are without redneſs; when they are cold and ſtiff; when they cannot eaſily be made to ſweat; or when, while a free and warm ſweat is brought out on the reſt of the body, it is only clammy and cold on the pained joints; and when, further, the pains of theſe are increaſed by cold, and relieved by heat, applied to them; the caſe is to be conſidered as that of a purely chronic rheumatiſm: or perhaps more properly the firſt of the conditions now deſcribed may be termed the ſtate of irritability, and the ſecond ſtate of atony.

The chronic rheumatiſm, or rather the atonic, may affect different joints; but is eſpecially apt to affect thoſe which are ſurrounded with many muſcles, and thoſe of which the muſcles are employed in the moſt conſtant and vigorous exertions. Such is the caſe of the vertebræ of the loins, the affection of which is named *lumbago*; or of the hip-joint, when the diſeaſe is named *iſchias* or *ſciatica*.

Violent ſtrains and ſpaſms occurring on ſudden and ſomewhat violent exertions, bring on rheumatic affections, which at firſt partake of the acute, but very ſoon change into the nature of the chronic, rheumatiſm.—Such are frequently the lumbago, and other affections, which ſeem to be more ſeated in the muſcles than in the joints. The diſtinction of the rheumatic pains from thoſe reſembling them which occur in the ſiphylis and ſcurvy muſt be obvious, either from the ſeat of the pains, or from the concomitant ſymptoms peculiar to thoſe diſeaſes. The diſtinction of the rheumatiſm from the gout will be more fully underſtood from what is laid down under the genus Podagra.

Cauſes, &c. The phenomena of the purely chronic rheumatiſm lead us to conclude, that its proximate cauſe is an atony both of the blood-veſſels and of the muſcular fibres of the part affected, together with ſuch a degree of rigidity and contraction in the latter as frequently attend them in a ſtate of atony: and indeed this atony, carried to a certain extent, gives riſe to a ſtate of paralyſis, with an almoſt total loſs of motion in the affected limbs. The paralytic ſtate of rheumatiſm therefore may be pointed out as a fourth condition of the diſeaſe, often claiming the attention of the practitioner.

Cure. From the view juſt now given of the proximate cauſe of chronic rheumatiſm, the chief indication of cure muſt be, to reſtore the activity and vigour of the part, which is principally to be done by increaſing the tone of the moving fibres, but which may ſometimes alſo be aided by giving condenſation to the ſimple ſolid. When, however, the diſeaſe has degenerated into the ſtate of paralyſis, the objects to be aimed at are, the reſtoration of a due condition to the nervous energy in the part affected; the obtaining free circulation of blood through the veſſels of the part; and the removal of rigidity in membranes and ligaments.

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For anſwering theſe purpoſes, a great variety of remedies, both external and internal, are had recourſe to. The chief of the external are, the ſupporting the heat of the part, by keeping it conſtantly covered with flannel; the increaſing the heat of the part by external heat, applied either in a dry or humid form; the diligent uſe of the fleſh-bruſh, or other means of friction; the application of electricity in ſparks or ſhocks; the application of cold water by affuſion or immerſion; the application of eſſential oils of the moſt warm and penetrating kind; the application of ſalt brine; the employment of the warm bath or of the vapour baths, either to the body in general or to particular parts; and laſtly, the employment either of exerciſe of the part itſelf as far as it can eaſily bear, or by riding or other modes of geſtation.

The internal remedies are, Large doſes of eſſential oils drawn from reſinous ſubſtances, ſuch as turpentine. Subſtances containing ſuch oils, as guaiac. Volatile alkaline ſalts. Theſe or other medicines are directed to procure ſweat; and calomel, or ſome other preparation of mercury, in ſmall doſes, may be continued for ſome time. Beſides theſe, there are ſeveral others recommended. The cicuta, aconitum, and hyoſciamus, have in particular been highly extolled; and an infuſion of the rhododendron chryſanthum is ſaid to be employed by the Siberians with very great ſucceſs. An account of the Siberian mode of practice is given by Dr Matthew Guthrie of Peterſburgh, in the fifth volume of the Edinburgh Medical Commentaries, and has been followed with ſucceſs at other places.

G. XXIV. ODONTALGIA, the Tooth-ach. 210

Odontalgia, *Sauv.* gen. 198. *Lin.* 45. *Vog.* 145. *Sag.* gen. 157. *Junck.* 25.
Odontalgia ſive rheumatiſmus odontalgicus, *Hoffm.* II. 330.
Odontalgia carioſa, *Sauv.* ſp. 1.
Odontalgia ſcorbutica *Sauv.* ſp. 4.
Odontalgia catarrhalis, *Sauv.* ſp. 3.
Odontalgia arthritica, *Sauv.* ſp. 6.
Odontalgia gravidarum, *Sauv.* ſp. 2.
Odontalgia hyſterica, *Sauv.* ſp. 3.
Odontalgia ſtomachica, *Sauv.* ſp. 9.

Deſcription. This well-known diſeaſe makes its attack by a moſt violent pain in the teeth, moſt frequently in the *molares*, more rarely in the *inciſorii*, reaching ſometimes up to the eyes, and ſometimes backward into the cavity of the ear. At the ſame time there is a manifeſt determination to the head, and a remarkable tenſion and inflation of the veſſels takes place, not only in the parts next to that where the pain is ſeated, but over the whole head.

Cauſes, &c. The tooth-ach is ſometimes merely a rheumatic affection, ariſing from cold, but more frequently from a carious tooth. It is alſo a ſymptom of pregnancy, and takes place in ſome nervous diſorders; it may attack perſons at any time of life, tho' it is moſt frequent in the young and plethoric.

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Cure. Many empirical remedies have been propoſed for the cure of the tooth-ach, but none have in any degree anſwered the purpoſe. When the affection is purely rheumatic, bliſtering behind the ear will almoſt always remove it; but when it proceeds from a carious tooth, the pain is much more obſtinate. In this caſe it has been recommended to touch the pained part with a hot iron, or with oil of vitriol, in order to deſtroy the aching nerve; to hold ſtrong ſpirits in the mouth; to put a drop of oil of cloves into the hollow of the tooth, or a pill of equal parts of opium and camphire: but one of the moſt uſeful applications of this kind is ſtrong nitrous acid, diluted with three or four times its weight of ſpirit of wine, and introduced into the hollow of a tooth from which great pain ariſes, either by means of an hair pencil or a little cotton. The Peruvian bark has alſo been recommended, and perhaps with more juſtice, on account of its tonic and antiſeptic powers; but very often all theſe remedies will fail, and the only infallible cure is to draw the tooth. See SURGERY.

211 GENUS XXIV. PODAGRA, the GOUT.

Podagra, *Vog.* 175. *Boerh.* 1254.
Febris podagrica, *Vog.* 69.
Arthritis, *Sauv.* gen. 183. *Lin.* 60. *Vog.* 139. *Sag.* gen. 142.
Dolor podagricus et arthriticus verus, *Hoffm.* II. 339.
Dolores arthritici, *Hoffm.* II. 317.
Affectus ſpaſtico-arthritici, *Junck.* 46.

212 Sp. I. The *Regular* GOUT.

Arthritis podagra, *Sauv.* ſp. 1.
Arthritis rachialgica, *Sauv.* ſp. 11.
Arthritis æſtiva, *Sauv.* ſp. 4.

213 Sp. II. The *Atonic* GOUT.

Arthritis melancholica, *Sauv.* ſp. 6.
Arthritis hiemalis, *Sauv.* ſp. 2.
Arthritis chlorotica, *Sauv.* ſp. 5.
Arthritis aſthmatica, *Sauv.* ſp. 9.

214 Sp. III. The *Retrocedent* GOUT.

215 Sp. IV. The *Miſplaced* GOUT.

Deſcription. What we call a *paroxyſm of the gout* is principally conſtituted by an inflammatory affection of ſome of the joints. This ſometimes comes on ſuddenly, without any warning, but is generally preceded by ſeveral ſymptoms; ſuch as the ceaſing of a ſweating which the feet had been commonly affected with before; an unuſual coldneſs of the feet and legs; a frequent numbneſs, alternating with a ſenſe of prickling along the whole of the lower extremities; frequent cramps of the muſcles of the legs; and an unuſual turgeſcence of the veins.

While theſe ſymptoms take place in the lower extremities, the body is affected with ſome degree of torpor and languor, and the functions of the ſtomach in particular are more or leſs diſturbed. The appetite is diminiſhed; and flatulency, or other ſymptoms of indigeſtion, are felt. Theſe ſymptoms take place for ſeveral days, ſometimes for a week or two, before a paroxyſm comes on; but commonly, upon the day immediately preceding it, the appetite becomes keener than uſual.

Podagra.

The circumſtances of paroxyſms are chiefly the following. they come on moſt commonly in the ſpring, and ſooner or later according as the vernal heat ſucceeds ſooner or later to the winter's cold; and, perhaps, ſooner or later alſo, according as the body may happen to be more or leſs expoſed to viciſſitudes of heat and cold.

The attacks are ſometimes felt firſt in the evening, but more commonly about two or three o'clock in the morning. The paroxyſm begins with a pain affecting one foot, moſt commonly in the ball or firſt joint of the great toe, but ſometimes in other parts of the foot. With the attack of this pain, there is commonly more or leſs of a cold ſhivering; which, as the pain increaſes, gradually ceaſes; and is ſucceeded by a hot ſtage of pyrexia, which continues for the ſame time with the pain itſelf. From the firſt attack, the pain becomes, by degrees, more violent, and continues in this ſtate with great reſtleſſneſs of the whole body till next midnight, after which it gradually remits; and, after it has continued for 24 hours from the commencement of the firſt attack, it commonly ceaſes almoſt entirely; and, with the coming on of a gentle ſweat, allows the patient to fall aſleep. The patient. upon coming out of this ſleep in the morning, finds the pained part affected with ſome redneſs and ſwelling, which, after having continued for ſome days, gradually abate.

When a paroxyſm has thus come on, although the violent pain after 24 hours be conſiderably abated, the patient is not entirely relieved from it. For ſome days he has every evening a return of more conſiderable pain and pyrexia, and theſe continue with more or leſs violence till morning. After going on in this manner for ſeveral days, the diſeaſe ſometimes goes entirely off, not till after a long interval.

When the diſeaſe, after having thus remained for ſome time in a joint, ceaſes entirely, it generally leaves the perſon in very perfect health, enjoying greater eaſe and alacrity in the functions of both body and mind than he had for a long time before experienced.

At the beginning of the diſeaſe, the returns of it are ſometimes only once in three or four years: but as it advances, the intervals become ſhorter, and at length the attacks are annual; afterwards they come twice each year; and at length recur ſeveral times during the courſe of autumn, winter, and ſpring; and as, when the fits are frequent, the paroxyſms become alſo longer, ſo, in the advanced ſtate of the diſeaſe, the patient is hardly ever tolerably free from it, except perhaps for two or three months in ſummer.

The progreſs of the diſeaſe is alſo marked by the parts which it affects. At firſt, it commonly affects one foot only; afterwards every paroxyſm affects both feet, the one after the other; and as the diſeaſe proceeds, it not only affects both feet at once, but, after having ceaſed in the foot which was ſecondly attacked, returns again into the firſt, and perhaps a ſecond time alſo into the other. Its changes of places are not only from one foot to another, but from the feet into other joints, eſpecially thoſe of the upper and lower extremities; ſo that there is hardly a joint of the body which,

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which, on one occasion or other, is not affected. It sometimes affects two different joints at the very same time; but more commonly it is at any one time severe in a single joint only, and passes in succession from one joint to another; so that the patient's affliction is often protracted for a long time.

When the disease has often returned, and the paroxysms have become very frequent, the pains are commonly less violent than they were at first; but the patient is more affected with sickness, and the other symptoms of the atonic gout, which shall be hereafter mentioned.

After the first paroxysm of the disease, the joints which have been affected are entirely restored to their former suppleness and strength; but after the disease has recurred very often, the joints affected do neither so suddenly nor entirely recover their former state, but continue weak and stiff; and these effects at length proceed to such a degree, that the joints lose their motion entirely.

In many persons, but not in all, after the disease has frequently recurred, concretions of a chalky nature are formed upon the outside of the joints, and for the most part immediately under the skin. The matter seems to be deposited at first in a fluid form, afterwards becoming dry and firm. In their firm state, these concretions are a hard earthy substance, very entirely soluble in acids. After they have been formed, they contribute, with other circumstances, to destroy the motion of the joint.

In most persons who have laboured under the gout for many years, a nephritic affection comes on, and discovers itself by all the symptoms which usually attend calculous concretions in the kidneys, and which we shall have occasion to describe in another place. All that is necessary to be observed here is, that the nephritic affection alternates with paroxysms of the gout, and that the two affections, the nephritic and the gouty, are hardly ever present at the same time. This also may be observed, that children of gouty or nephritic parents commonly inherit one or other of these diseases; but whether the principal disease of the parent may have been either gout or nephritis alone, some of the children have the one and some the other. In some of them, the nephritic affection occurs alone, without any gout supervening; and this happens to be frequently the case with the female children of gouty parents.

In the whole of the history already given, we have described the most common form of the disease, and which therefore, however diversified in the progress of it, may be still called the regular state of the gout.—Upon some occasions, however, the disease assumes different appearances: but as we suppose the disease to depend always upon a certain diathesis, or disposition of the system; so every appearance which we can perceive to depend upon that same disposion, we still consider as a symptom and case of the gout. The principal circumstance, in what we term the *regular gout*, is the inflammatory affection of the joints; and whatever symptoms we can perceive to be connected with, or to depend upon, the disposition which produces that inflammatory affection, but without its taking place or being present at the same time, we name the *irregular gout*.

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Of such irregular gout there are three different states, which may be named the *atonic*, the *retrocedent*, and the *misplaced* gout.

The first is, when the gouty diathesis prevails in the system; but from certain causes, does not produce the inflammatory affection of the joints. In this case, the morbid symptoms which appear, are chiefly affections of the stomach, such as loss of appetite, indigestion, and its various attendants of sickness, nausea, vomiting, flatulency, acid eructations, and pains in the region of the stomach. These symptoms are frequently accompanied with pains and cramps in several parts of the trunk and the upper extremities of the body, which are relieved by the discharge of wind from the stomach. Together with these affections of the stomach, there commonly occurs a costiveness; but sometimes a looseness, with colic pains. These affections of the alimentary canal are often attended with all the symptoms of hypochondriasis, such as dejection of mind, a constant and anxious attention to the slightest feelings, an imaginary aggravation of these, and an apprehension of danger from them.

In the same atonic gout, the viscera of the thorax also are sometimes affected, and palpitations, faintings, and asthma, occur.

In the head also occur headachs, giddiness, apoplectic and paralytic affections.

When the several symptoms now mentioned occur in habits having the marks of a gouty disposition, this may be suspected to have laid the foundation of them; and especially when either, in such habits, a manifest tendency to the inflammatory affection has formerly appeared, or when the symptoms mentioned are intermixed with and are relieved by some degree of the inflamatory gout. In such cases there can be no doubt of considering the whole as a state of the gout.

Another state of the disease we name the *retrocedent* gout. This occurs when an inflammatory state of the joints has, in the usual manner, come on, but without arising to the ordinary degree of pain and inflammation; or at least without these continuing for the usual time, or without their receding gradually in the usual manner; these affections of the joints suddenly and entirely cease, while some internal part becomes affected. The internal part most commonly attacked is the stomach; which then is affected with anxiety, sickness, vomiting, or violent pain: but sometimes the internal part is the heart, which gives occasion to a syncope; some times it is the lungs, which are affected with asthma; and sometimes it is the head, giving occasion to apoplexy or palsy. In all these cases there can be no doubt that the symptoms are all a part of the same disease, however different the affection may seem to be in the parts which it attacks.

The third state of irregular gout, which we name the *misplaced*, is when the gouty diathesis, instead of producing the inflammatory affection of the joints, produces an inflammatory affection of some internal part, and which appears from the same symptoms that attend the inflammations of those parts arising from other causes.

Whether the gouty diathesis does ever produce such inflammation of the internal parts without having first produced it in the joints, or whether the inflammation of

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of the internal part be always a tranſlation from the joints previouſly affected, we dare not determine; but, even ſuppoſing the latter to be always the caſe, we think the difference of the affection of the internal part muſt ſtill diſtinguiſh the *miſplaced* from what we have named the *retrocedent gout*.

With regard to the miſplaced gout, Dr Cullen, whom we here follow, tells us, that he never met with any caſes of it in his practice, nor does he find any diſtinctly marked by practical writers, except that of a pneumonic inflammation.

There are two caſes of a tranſlated gout; the one of which is an affection of the neck of the bladder, producing pain, ſtrangury, and a *catarrhus veſicæ*: the other is an affection of the rectum, ſometimes indicated by pain alone in that part, and ſometimes by hæmorrhoidal ſymptoms. In gouty perſons ſuch affections have been known to alternate with inflammatory affections of the joints; but whether theſe belong to the retrocedent or to the miſplaced gout, our author pretends not to determine.

It is commonly ſuppoſed, that there are ſome caſes of rheumatiſm which are ſcarcely to be diſtinguiſhed from the gout: but theſe, Dr Cullen thinks, are but few; and that the two diſeaſes may be for the moſt part diſtinguiſhed with great certainty, by obſerving the prediſpoſition, the antecedent circumſtances, the parts affected, the recurrences of the diſeaſe, and its connection with the ſyſtem; which circumſtances, for the moſt part, appear very differently in the two diſeaſes.

Cauſes, &c. The gout is generally an heriditary diſeaſe: but ſome perſons, without any hereditary diſpoſition, ſeem to acquire it; and in ſome an hereditary diſpoſition may be counteracted from various cauſes. It attacks the male ſex eſpecially; but it ſometimes, tho' more rarely, attacks alſo the female. The females liable to it are thoſe of the more robuſt and full habits; and it very often happens to thoſe before the menſtrual evacuation hath ceaſed. Dr Cullen hath alſo found it occurring in ſeveral females whoſe menſtrual evacuations were more abundant than uſual.

The gout ſeldom attacks eunuchs; and when it does, ſeem to fall upon thoſe who happen to be of a robuſt habit, to lead an indolent life, and to live very full. It attacks eſpecially men of robuſt and large bodies, who have large heads, are of full and corpulent habits, and whoſe ſkins are covered with a thicker *rete mucoſum*, which gives a coarſer ſurface. To ſpeak in the ſtyle of the ancient phyſicians, the gout will ſeldom be found to attack thoſe of a ſanguine, or ſuch as are of a purely melancholic temperament; but very readily thoſe of a *cholerico-ſanguine* temperament. It is, however, very difficult to treat this matter with preciſion. The gout ſeldom attacks perſons employed in conſtant bodily labour, or thoſe who live much upon vegetable aliment. It does not commonly attack men till after the age of 35; and generally not till a ſtill later period. There are indeed inſtances of the gout appearing more early; but theſe are few in compariſon of the others. When the diſeaſe does appear early in life, it ſeems to be in thoſe who have the hereditary diſpoſition very ſtrong, and to whom the remote cauſes hereafter mentioned have been applied in a very conſiderable degree.

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As the gout is an heriditary diſeaſe, and affects men particularly of a certin habit, its remote cauſes may be conſidered as prediſponent and occaſional. The prediſponent cauſe, as far as expreſſed by external appearances, has been already marked; and phyſicians have been very confident in aſſigning the occaſional cauſes: but in a diſeaſe depending ſo much upon a prediſpoſition, the aſſigning occaſional cauſes muſt be uncertain; as in the prediſpoſed the occaſional cauſes may not always appear, and in perſons not prediſpoſed they may appear without effect; and this uncertainty muſt particularly affect the caſe of the gout.

The occaſional cauſes of the diſeaſe ſeem to be of two kinds. Firſt, thoſe which induce a phlethoric ſtate of the body. Secondly, thoſe which in plethoric habits, induce a ſtate of debility. Of the firſt kind are a ſedentary, indolent manner of life, and a full diet of animal-food. Of the ſecond kind of occaſional cauſes which induce debility are exceſs in venery; intemperance in the uſe of intoxicating liquors; indigeſtion, produced either by the quantity or quality of the aliments; much application to ſtudy or buſineſs, night-watching, exceſſive evacuations; the ceaſing of uſual labour; a ſudden change from a very full to a very ſpare diet; the large uſe of acids and aceſcents; and laſtly, cold applied to the lower extremities. The former ſeem to act by increaſing the prediſpoſition; the latter are commonly the exciting cauſes, both of the firſt attacks, and of the repetitions of the diſeaſe.

With reſpect to the proximate cauſe of the gout, it has generally been thought that it depends on a certain morbific matter always preſent in the body; and that this matter, by certain cauſes, thrown upon the joints or other parts, produces the ſeveral phenomena of the diſeaſe.

This doctrine, however ancient and generally received, appears to Dr Cullen to be very doubtful. For,

Firſt, there is no direct evidence of any morbific matter being preſent in perſons diſpoſed to the gout. There are no experiments or obſervations which ſhow that the blood or other humours of gouty perſons are in any reſpect different from thoſe of others. Previous to attacks of the gout, there appear no marks of any morbid ſtate of the fluids; for the diſeaſe generally attacks thoſe perſons who have enjoyed the moſt perfect health, and appear to be in that ſtate when the diſeaſe comes on. At a certain period of the diſeaſe, a peculiar matter indeed appears in gouty perſons; but this, which does not appear in every inſtance, and which appears only after the diſeaſe has ſubſiſted for a long time, ſeems manifeſtly to be the effect, not the cauſe, of the diſeaſe. Further, though there be certain acrids which, taken into the body, ſeem to excite the gout, it is probable that theſe acrids operate otherwiſe in exciting the diſeaſe, than by affording the material cauſe of it. In general, therefore, Dr Cullen thinks there is no proof of any morbific matter being the cauſe of the gout.

Secondly, the ſuppoſitions concerning the particular nature of the matter producing the gout, have been ſo various, and ſo contradictory, as to allow us to conclude, that there is truly no proof of the exiſtence of

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of any of them. With respect to many of these suppositions, they are so inconsistent with chemical philosopy, and with the laws of the animal œconomy, that they must be entirely rejected.

Thirdly, the supposition of a morbific matter as the cause is not consistent with the phenomena of the disease, particularly with its frequent and sudden translations from one part to another.

Fourthly, the supposition is further rendered improbable by this, that, if a morbific matter did exist, its operation should be similar in the several parts which it attacks; whereas it seems to be very different, being stimulant, and exciting inflammation, in the joints; but sedative and destroying the tone in the stomach: which, upon the supposition of the same particular matter acting in both cases, is not to be explained by any difference in the part affected.

Fifthly, Some facts alledged in proof of a morbific matter, are not sufficiently confirmed; such as those which would prove the disease to be contagious. There is, however, no proper evidence of this, the facts given being not only few, but exceptionable, and the negative observations innumerable.

Sixthly, Some arguments brought in favour of a morbific matter are founded upon a mistaken explanation. The disease has been supposed to depend upon a morbific matter, because it is hereditary. But the inference is not just; for most hereditary diseases do not depend upon any morbific matter, but upon a particular conformation of the structure of the body transmitted from the parent to the offspring; and this last appears to be particularly the case in the gout. It may be also observed, that hereditary diseases depending upon a morbific matter, appear always much more early in life than the gout commonly does.

Seventhly, The supposition of a morbific matter being the cause of the gout, has been hitherto useless, as it has not suggested any successful method of cure. Particular theories of gout have often corrupted the practice, and have frequently led from those views which might have been useful, and from that practice which experience had approved. Further, though the supposition of a morbific matter has been generally received, it has been as generally neglected in practice. When the gout has affected the stomach, nobody thinks of correcting the matter supposed to be present there, but merely of restoring the tone of the moving fibres.

Eigthly, The supposition of a morbific matter is quite superfluous: for it explains nothing without supposing that matter to produce a change in the state of the moving powers; and a change in the state of the moving powers, produced by other causes, explains every circumstance without the supposition of a morbific matter; and it may be observed, that many of the causes exciting the gout, do not operate upon the state of the fluids, but directly and solely upon that of the moving powers.

Lastly, Dr Cullen contends that the supposition of a morbific matter is superfluous; because, without that, the disease can be explained, he thinks, in a manner more consistent with its phenomena, with the laws of the animal œconomy, and with the method of cure which experience has approved. We now proceed to give this explanation; but, before entering upon it, we must premise some general observations which Dr Cullen states.

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The first observation is, That the gout is a disease of the whole system, or depends upon a certain general conformation and state of the body, which manifestly appears from the facts abovementionned. But the general state of the system depends chiefly upon the state of its primary moving powers; and therefore the gout may be supposed to be an affection of these chiefly.

The second observation is, That the gout is manifestly an affection of the nervous system; in which the primary moving powers of the whole system are lodged. The occasional or exciting causes are almost all such as act directly upon the nerves and nervous system; and the greater part of the symptoms of the atonic or retrocedent gout are manifestly affections of the same system. This leads us to seek for an explanation of the whole of the disease, in the laws of the nervous system, and particularly in the changes which may happen in the balance of its several parts.

The third observation is, That the stomach, which has so universal a consent with the rest of the system, is the internal part that is the most frequently, and often very considerably, affected by the gout. The paroxysms of the disease are commonly preceded by an affection of the stomach; many of the exciting causes act first upon the stomach, and the symptoms of the atonic and retrocedent gout are most commonly and chiefly affections of the same organ. This observation leads us to remark, that there is a balance subsisting between the state of the internal and that of the external parts; and in particular that the state of the stomach is connected with that of the external parts, so that the state of tone in the one may be communicated to the other.

These observations being premised, Dr Cullen offers the following pathology of the gout.

In some persons there is a certain vigorous and plethoric state of the system, which at a certain period of life is liable to a loss of tone in the extremities. This is in some measure communicated to the whole system, but appears more especially in the functions of the stomach. When this loss of tone occurs while the energy of the brain still retains its vigour, the *vis medicatrix naturæ* is excited to restore the tone of the parts; and accomplishes it, by exciting an inflammatory affection in some part of the extremities. When this has subsisted for some days, the tone of the extremities and of the whole system is restored, and the patient returns to his ordinary state of health.

This is the course of things in the ordinary form of the disease, which we name the *regular gout;* but there are circumstances of the body, in which this course is interrupted or varied. Thus, when the atony has taken place, if the reaction do not succeed, the atony continues in the stomach, or perhaps in other internal parts; and produces that state which Dr Cullen, for reasons now obvious, named the *atonic gout*.

A second case of variation in the course of the gout is, when to the atony the reaction and inflammation have to a certain degree succeeded, but from causes either internal or external the tone of the extremities and perhaps of the whole system is weakened; so that the inflammatory state, before it had either proceeded to the degree, or continued for the time, requisite for restoring

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restoring the tone of the system, suddenly and entirely ceases: whence the stomach and other internal parts, relapse into the state of atony; and perhaps have that increased by the atony communicated from the extremities: all which appears in what has been termed the *retrocedent state of the gout*.

A third case of variation from the ordinary course of the gout, is, when to the atony, usually preceding, an inflammatory reaction fully succeeds, but has its usual determination to the joints by some circumstances prevented; and is therefore directed to some internal part, where it produces an inflammatory affection, and that state of things which we have named the *misplaced gout*.

Though this theory of Dr Cullen's be supported with much ingenuity, yet we may confidently venture to assert, that on this subject he has been less successful in establishing his own opinion, than in combating those of others; and this theory, as well as others formerly proposed, is liable to numerous and unsurmountable objections. According to the hypothesis, a vigourous and phlethoric habit should in every case exist prior to the appearance of gout; which is by no means consistent with fact; nor is it true that a vigorous and phlethoric habit is liable at a certain age to a loss of tone in the extremities; which is another necessary condition in the hypothesis. Loss of tone often occurs in the extremities without exerting any peculiar influence on the stomach; and why a loss of tone in the stomach should excite the *vis medicatrix naturæ*, to restore it by exciting an inflammatory affection in some part of the extremities, is very inconceivable. Were the hypothesis true, every dyspeptic patient should infallibly be affected with gout; which, however, is by no means the case. In short, every step in the theory is liable to unsurmountable objections; and it by no means, any more than former hypotheses, explains the phenomena of the disease, particularly what Dr Cullen has himself so accurately pointed out, the connection of gouty with calculous complaints.

A very ingenious work has lately been published by an anonymous author, entitled "a Treatise on Gravel and upon Gout;" in which the sources of each are investigated, and effectual means of preventing or removing these diseases recommended. In this treatise an attempt is made to prove, that both diseases depend upon a peculiar concreting acid, the acid of calculi, or the *lithic acid*, as it has been styled by some. He supposes this acid, constantly present to a certain degree in the circulating fluids, to be precipitated by the introduction of other acids; and in this manner he explains the influence of acid wines and other liquors, as claret, cyder, &c. inducing gout; for he considers the circumstance chiefly constituting the disease as being an inflammation in parts of which the functions have been interrupted by the redundant acid precipitated. Although this theory be supported with much ingenuity, yet it is also liable to many objections. The sudden attack of the affection; its sudden transition from one part of the body to another; the instant relief of one part when another comes to be affected; and the various anomalous forms which the disease puts on, having an exact resemblance to different affections; are altogether irreconcileable to the idea of its depending on any fixed obstruction at a particular part arising from concreting acid. Nor does the plan of prevention and cure which he proposes, and which consist chiefly in abstinence from acid and in the destruction of acid, by any means correspond in every particular to best established facts respecting the treatment of gout; to which we next proceed.

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Cure. In entering upon this, we must observe, in the first place, that a cure has been commonly thought impossible; and we acknowledge it to be very probable, that the gout, as a disease of the whole habit, and very often depending upon original conformation, cannot be cured by medicines, the effects of which are always very transitory, and seldom extend to the producing any considerable change of the whole habit.

It would perhaps have been happy for gouty persons if this opinion had been implicitly received by them; as it would have prevented their having been so often the dupes of self-interested pretenders, who have either amused them with inert medicines, or have rashly employed those of the most pernicious tendency. Dr Cullen, who has treated of the cure of the disease with great judgment, as he has done the theory with much ingenuity, is much disposed to believe the impossibility of a cure of the gout by medicines; and more certainly still inclined to think, that, whatever may be the possible power of medicines, yet no medicine for curing the gout has hitherto been found. Although almost every age has presented a new remedy, all hitherto offered have, very soon after, been either neglected as useless, or condemned as pernicious.

But, though unwilling to admit the power of medicines, yet he contends, that a great deal can be done towards the cure of the gout by a regimen: and he is firmly persuaded, that any man who, early in life, will enter upon the constant practice of bodily labour and of abstinence from animal-food, will be preserved entirely from the disease.

Whether there be any other means of radically curing the gout, the Doctor is not ready to determine. There are histories of cases of the gout, in which it is said, that by great emotions of mind, by wounds, and by other accidents, the symptoms have been suddenly relieved, and never again returned; but how far these accidental cures might be imitated by art, or would succed in other cases, is at least extremely uncertain.

The practices proper and necessary in the treatment of the gout, are to be considered under two heads; *First*, As they are to be employed in the intervals of paroxysms; or, *secondly*, As during the time of these. In the intervals of paroxysms, the indications are, to prevent altogether the return of paroxysms; or at least to render them less frequent, and more moderate. During the time of paroxysms, the indications are, to moderate the violence and shorten the duration of them as much as can be done with safety.

It has been already observed, that the gout may be entirely prevented by constant bodily exercise, and by a low diet; and Dr Cullen is of opinion that this prevention may take place even in persons who have a hereditary disposition to the disease. Even when the disposition has discovered itself by several paroxysms of inflammatory gout, he is persuaded that labour and abstinence will absolutely prevent any returns of it for the

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the rest of life. These, therefore, are the means of answering the first indication to be pursued in the intervals of paroxysms.

Exercise in persons disposed to the gout, in Dr Cullen's opinnion, has effect by answering two purposes: One of these is the strengthening of the tone of the extreme vessels; and the other, the guarding against a plethoric state. For the former, if exercise be employed early in life and before intemperance has weakened the body, a very moderate degree of it will answer the purpose; and, for the latter, if abstinence be at the same time observed, little exercise will be necessary.

With respect to exercise, this in general is to be observed, that it should never be violent; for, if violent it cannot be long continued, and must always endanger the bringing on an atony in proportion to the violence of the preceding exercise.

It is also to be observed, that the exercise of gestation, though considerable and constant, will not, if it be entirely without bodily exercise, answer the purpose in preventing the gout. For this end, therefore, the excercise must be in some measure that of the body, and must be moderate, but at the same time constant and continued through life.

In every case and circumstance of the gout in which the patient retains the use of his limbs, bodily exercise, in the intervals of paroxysms, will be always useful; and in the beginning of the disease, when the disposition to it is not yet strong, exercise, may prevent a paroxysm which otherwise might have come on. In more advanced states of the disease, however, when there is some disposition to a paroxysm, much walking will bring it on, either as it weakens the tone of the lower extremities, or as it excites an inflammatory disposition in them; and thus it seems to be that strains or contusions often bring on a paroxysm of the gout.

Abstinence, the other part of the proper regimen for preventing, the gout is of more difficult application. If an abstinence from animal food be entered upon early in life, while the vigour of the system is yet entire, Dr Cullen has no doubt of its being both safe and effectual; but if the motive for this diet shall not have occurred till the constitution has been broken by intemperance or by the decline of life, a low diet may then endanger the bringing on an atonic state.

Further, if a low diet be entered upon only in the decline of life, and be at the same time a very great change from the former manner of living, the withdrawing of an accustomed stimulus of the system may readily throw this into an atonic state.

The safety of an abstemions course may be greater or less according to the management of it. It is animal food which especially disposes to the plethoric and inflammatory state, and that food is to be therefore especially avoided; but, on the other hand, vegetable aliment of the lowest quality is in danger of weakening the system too much by not affording sufficient nourishment, and more particularly of weakening the tone of the stomach by its acescency. It is therefore a diet of a middle nature that is to be chosen; and milk is precisely of this kind, as containing both animal and vegetable matter.

As approaching to the nature of milk, and as being a vegetable matter containing the greatest portion of nourishment, the farinacious seeds are next to be chosen, and are the food most proper to be joined with milk.

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With respect to drink, fermented liquors are useful only when they are joined with animal food, and that by their acescency; and their stimulus is only necessary from custom. When, therefore, animal food is to be avoided, fermented liquors are unnecessary; and by increasing the acescency of vegetables, these liquors may be hurtful. The stimulus of fermented or spirituous liquors is not necessary to the young and vigorous, and when much employed impairs the tone of the system. These liquors, therefore, are to be avoided, except so far as custom and the declining state of the system may have rendered them necessary. For preventing or moderating the regular gout, water is the only proper drink.

With respect to an abstemious course, it has been supposed, that an abstinence from animal food and fermented liquors, or the living upon milk and farinacea alone for the space of one year, might be sufficient for a radical cure of the gout; and it is possible that, at a certain period of life, in certain circumstances of the constitution, such a measure might answer the purpose But this is very doubtful; and it is more probable, that the abstinence must, in a great measure, be continued, and the milk-diet be persisted in, for the remainder of life. It is well known, that several persons who had entered on an abstemious course, and had been thereby delivered from the gout, have, however, upon returning to their former manner of full living, had the disease return upon them with as much violence as before, or in a more irregular and more dangerous form.

It has been alleged, that, for preventing the return of the gout, blood-letting or scarifications of the feet, frequently repeated, and at stated times, may be practised with advantage; but of this Dr Cullen tells us he has had no experience; and the benefit of the practice is not, as far as we know, confirmed by the observation of any other practitioner.

Exercise and abstinence are the means of avoiding the plethoric state which gives the disposition to the gout; and are therefore the means proposed for preventing the paroxysms, or at least for rendering them less frequent and more moderate. But many circumstances prevent the steadiness necessary in pursuing these measures; and therefore, in such cases, unless great care be taken to avoid the exciting causes, the disease may frequently return; and, in many cases, the preventing of paroxysms is chiefly to be obtained by avoiding those exciting causes already enumerated.

A due attention in avoiding these different causes will certainly prevent fits of the gout; and the taking care that the exciting causes be never applied in a great degree, will certainly render fits more moderate when they do come on. But, upon the whole, it will appear, that a strict attention to the general conduct of life, is in this matter necessary; and therefore, when the predisposition has taken place, it will be extremely difficult to avoid the disease.

Dr Cullen is firmly persuaded, that, by obviating the predisposition, and by avoiding the exciting causes, the gout may be entirely prevented, but, as the mea-

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ſures neceſſary for this purpoſe will, in moſt caſes, be purſued with difficulty, and even with reluctance, men have been very deſirous to find a medicine which might anſwer the purpoſe without any reſtraint on their manner of living. To gratify this deſire, phyſicians have propoſed, and, to take advantage of it, empirics have feigned, many remedies. Of what nature ſeveral of theſe remedies have been, it is difficult to ſay; but of thoſe which are unknown, we conclude, from their having been only of temporary fame, and from their having ſoon fallen into neglect, that they have been either inert or pernicious, and therefore ſhall make no inquiry after them; and ſhall now remark only upon one or two known remedies for the gout which have been lately in vogue.

One of theſe is what has been named in England the *Portland powder*. This is not a new medicine, but is mentioned by Galen, and, with ſome little variation in its compoſition, has been mentioned by the writers of almoſt every age ſince that time. It appears to have been at times in faſhion, and to have again fallen into neglect; and Dr Cullen thinks that this laſt has been owing to its having been found to be, in many inſtances, pernicious. In every inſtance which he has known of his exhibition for the length of time preſcribed, the perſons who had taken it were indeed afterwards free from any inflamatory affection of the joints; but they were affected with many ſymptoms of the atonic gout; and all, ſoon after finiſhing their courſe of the medicine, have been attacked with apoplexy, aſthma, or dropſy, which proved fatal.

Another remedy which has had the appearance of preventing the gout, is an alkali in various forms; ſuch as the fixed alkali, both mild and cauſtic, lime-water, ſoap, and abſorbent earths; and of late the alkaline aerated water has been more faſhionable than any other. Since it became common to exhibit theſe medicines in nephritic and calculous caſes, it has often happened that they were given to thoſe who were at the ſame time ſubject to the gout; and it has been obſerved, that under the uſe of theſe medicines, gouty perſons have been longer free from the fits of their diſeaſe. That, however, the uſe of theſe medicines has entirely prevented the returns of gout, Dr Cullen does not know; becauſe he never puſhed the uſe of thoſe medicines for a long time, being apprehenſive that the long-continued uſe of them might produce a hurtful change in the ſtate of the fluids.

As the preventing the gout depends very much on ſupporting the tone of the ſtomach, and avoiding indigeſtion; ſo coſtiveneſs, by occaſioning this, is very hurtful to gouty perſons. It is therefore neceſſary for ſuch perſons to prevent or remove coſtiveneſs, and by a laxative medicine, when needful; but it is at the ſame time proper, that the medicine employed ſhould be ſuch as may keep the belly regular, without much purging. Aloetics, rhubarb, magneſia alba, oleum ricini, or flowers of ſulphur, may be employed, as the one or the other may happen to be beſt ſuited to particular perſons.

Theſe are the ſeveral meaſures to be purſued in the intervals of the paroxyſms; and we are next to mention the meaſures proper during the time of them.

As during the time of paroxyſms the body is in a feveriſh ſtate, no irritation ſhould then be added to it; every part, therefore, of the antiphlogiſtic regimen except the application of cold, ought to be ſtrictly obſerved.

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Another exception to the general rule may occur when the tone of the ſtomach is weak, and when the patient has been before much accuſtomed to the uſe of ſtrong drink; for then it may be allowable, and even neceſſary, to give ſome animal-food and a little wine.

That no irritation is to be added to the ſyſtem during the paroxyſms of gout, except in the caſes mentioned, is agreed upon among phyſicians; but it is a more difficult matter to determine, whether, during the time of paroxyſms, any meaſures may be purſued to moderate the violence of reaction and of inflammation. Dr Sydenham has given it as his opinion, that the more violent the inflammation and pain, the paroxyſm will be the ſhorter, as well as the interval between the preſent and the next paroxyſm longer: and, if this opinion be admitted as juſt, it will forbid the uſe of any remedies which might moderate the inflammation; which is, to a certain degree, undoubtedly neceſſary for the health of the body. On the other hand, acute pain preſſes for relief; and although a certain degree of inflammation may ſeem abſolutely neceſſary, it is not certain but that a moderate degree of it may anſwer the purpoſe; and it is even probable, that in many caſes the violence of inflammation may weaken the tone of the parts, and thereby invite a return of paroxyſms. It ſeems to be in this way, that, as the diſeaſe advances, the paroxyſms become more frequent.

From theſe laſt conſiderations, it ſeems probable, that during the time of paroxyſms, ſome meaſures may be taken to moderate, the violence of the inflammation and pain, and particularly, that in firſt paroxyſms, and in the young and vigorous, blood-letting at the arm may be practiſed with advantage: but this practice cannot be repeated often with ſafety; becauſe blood-letting not only weakens the tone of the ſyſtem, but may alſo contribute to produce plethora. However, bleeding by leeches on the foot, and upon the inflamed part, may be practiſed and repeated with greater ſafety: and inſtances have been known of its having been employed with ſafety to moderate and ſhorten paroxyſms; but how far it may be carried, we have not had experience enough to determine.

Beſides blood-letting and the antiphlogiſtic regimen, it has been propoſed to employ remedies for moderating the inflammatory ſpaſm of the part affected, ſuch as warm bathing and emollient poultices. Theſe have ſometimes been employed with advantage and ſafety; but at other times, have been found to give occaſion to a retroceſſion of the gout.

Bliſtering is a very effectual means of relieving and diſcuſſing a paroxyſm of the gout; but has alſo frequently had the effect of rendering it retrocedent. The ſtinging with nettles is analogous to bliſtering; and probably would be attended with the ſame danger. The burning with moxa, or other ſubſtances, is a remedy of the ſame kind; but though not found hurtful, there is no ſufficient evidence of its proving a radical cure.

Camphire, and ſome aromatic oils, have the power of

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of allaying the pain, and of removing the inflammation from the part affected: but these remedies commonly make the inflammation only shift from one part to another and therefore with the hazard of its falling upon a part where it may be more dangerous, and they have sometimes rendered the gout retrocedent.

From these reflections it will appear, that some danger must attend every external application to the parts affected during a paroxysm; and that therefore the common practice of committing the person to patience and flannel alone, is established upon the best foundation. Opiates give the most certain relief from pain but, when given in the beginning of gouty paroxysms, it has by some been thought that they occasion these to return with greater violence. When, however, the paroxysms shall have abated in their violence, but still continue to return, so as to occasion painful and restless nights, opiates may be given with safety and advantage; especially in the case of persons advanced in life, and who have been often affected with the disease. When, after paroxysms have ceased, some swelling and stiffness still remain in the joints, these symptoms are to be discussed by the diligent use of the flesh-brush. Purging immediately after a paroxysm will be always employed with the hazard of bringing it on again.

Thus far of the REGULAR gout. We now proceed to consider the management of the disease when it has become IRREGULAR.

In the *atonic* gout, the cure is to be accomplished by carefully avoiding all debilitating causes; and by employing, at the same time, the means of strengthening the system in general, and the stomach in particular.

For strengthening the system in general, Dr Cullen recommends frequent exercise on horseback, and moderate walking. Cold bathing also may answer the purpose, and may be safely employed, if it appear to be powerful in stimulating the system, and be not applied when the extremities are threatened with any pain.

For supporting the tone of the system in general, when threatened with atonic gout, some animal food ought to be employed, and the more acescent vegetables ought to be avoided. In the same case, some wine also may be necessary; but it should be in moderate quantity, and of the least acescent kinds: and if every kind of wine shall be found to increase the acidity of the stomach, ardent spirits and water must be employed.

For strengthening the stomach, bitters and the Peruvian bark may be employed; but care must be taken that they be not constantly employed for any great length of time.

The most effectual medicine for strengthening the stomach is iron, which may be employed under various preparations; but the best appears to be the rust in fine powder, which may be given in large doses.

For supporting the tone of the stomach, aromatics may be employed; but should be used with caution, as the frequent and copious use of them have an opposite effect; and they should therefore be given only in compliance with former habits, or for palliating present symptoms.

When the stomach happens to be liable to indigestion, gentle vomits may be frequently given, and proper laxatives should be always employed to obviate or to remove costiveness.

Podagra.

In the atonic gout, or in persons liable to it, to guard against cold is especially necessary; and the most certain means of doing this, is by repairing to a warm climate during the winter season. In the more violent cases, blistering the lower extremities may be useful; but that remedy should be avoided when any pain threatens the extremities. In persons liable to the atonic gout, issues may be established in the extremities as in some measure a supplement to the disease.

A second case of the irregular gout, is the *retrocedent*.

When this affects the stomach and intestines, relief is to be instantly attempted by the free use of strong wines, joined with aromatics, and given warm; or, if these shall not prove powerful enough, ardent spirits must be employed, and are to be given in a large dose. In moderate attacks, ardent spirits, impregnated with garlic or with asafœtida, may be employed; or, even without the ardent spirits, a solution of asafœtida, with the volatile alkali, may answer the purpose. Opiates are often an effectual remedy; and may be joined with aromatics, as in the electuarium opiatum or they may be usefully joined with volatile alkali and camphire. Musk has likewise proved useful in this disease.

When the affection of the stomach is accompanied with vomiting, this may be encouraged by taking draughts of warm wine, at first with water, and afterwards without it; having at length recourse, if necessary, to some of the remedies abovementioned, and particularly the opiates.

In like manner, if the intestines be affected with diarrhœa, this is to be at first encouraged by taking plentifully of weak broth; and when this shall have been done sufficiently, the tumult is to be quieted by opiates.

When the retrocedent gout shall affect the lungs, and produce asthma, this is to be cured by opiates, by antispasmodics, and perhaps by blistering on the back or breast.

When the gout, leaving the extremities, shall affect the head, and produce pain, vertigo, apoplexy, or palsy, our resources are very precarious. The most probable means of relief is, blistering the head; and, if the gout shall have receded very entirely from the extremities, blisters may be applied to these also. Together with these blisterings, aromatics, and the volatile alkali, may be thrown into the stomach.

The third case of the irregular gout is the *misplaced*; that is, when the inflammatory affection of the gout, instead of falling upon the extremities, falls upon some internal part. In this case, the disease is to be treated by blood-letting, and by such other remedies as would be proper in an idiopathic inflammation of the same parts.

Whether the translation so frequently made from the extremities to the kidneys, is to be considered as an instance of the misplaced gout seems uncertain: but Dr Cullen is disposed to think it something different; and therefore is of opinion, that, in the *nephralgia calculosa* produced upon this occasion, the remedies of inflammation are to be employed no farther than they

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may be otherwise sometimes necessary in that disease, arising from other causes than the gout.

To this dissertation on the gout, taken from the works of our late learned professor, we cannot help subjoining a very uncommon case published by Dr Samuel Pye in the London Medical Transactions, where the gout would seem to have been occasioned by a morbific matter, and to have been cured by the evacuation of it.

"Mr Major Rook, surgeon and apothecary in Upper Shadwell, of about 45 years of age, a sober, temperate man, of a good habit of body, accustomed to no disease but the gout; the returns of the fits whereof had never been more frequent than once in 12 or 14 months, about the month of June 1752 was seized with a very severe paroxysm of the gout. As I had known some extraordinary effects proceeding from a vegetable diet in that distemper, particularly in one gentleman, who, by a total abstinence from all manner of food except cow's milk, and that without bread, had cured himself of this disease; and who, at the time I mentioned the case to my friend, was in the 13th year of his milk-diet; I persuaded Mr Rook to try what vegetables would do for him: he readily complied, and entered upon it immediately, with a resolution, that, if it answered his expectation, he would renounce fish and flesh for ever.

"But after the most religious abstinence from animal food of every kind for eleven weeks, being visited by a gentle attack in both feet, he returned immediately to his animal food. This paroxysm continued but 48 hours; but in March 1753 was succeded by a very severe one in both feet.

"The pain in his feet, heels, and ankles, increased with great violence for about 10 or 12 days; till at length he was in the most extreme agonies; such as he had never felt before, and such as almost made him mad. In the height of this extremity the pains (it is his own expression) from the feet, heels, and ankles, flew as quick as lightning directly to the calves of his legs; but remaining there not half a minute, and not in the least abating of their extreme violence (though the feet, heels, and ankles, were left entirely free from pain), from the calves, after a short stay of about half a minute, the pains ascended with the same velocity as before to both the thighs, at the same time leaving the calves of the legs free from pain from the thighs, in less than the space of one minute, and as quick as before, they arrived at the abdomen; and after giving the patient one most severe twitch in the bowels, they reached the stomach: here the pains and here the fit ended, upon the patient's vomiting up about a pint and a half of a green aqueous liquor, but so extremely corrosive, that he compared it to the strongest mineral acid.

"This extraordinary crisis happened at about two in the morning: immediately after this discharge he fell asleep, and slept till seven or eight, and waked perfectly easy in every part, no signs of the distemper remaining but the swelling and tenderness of his feet; both of which went off gradually, so that in two days he was able to walk about his business.

"The next fit seized him in February 1754, in the common way; but was less violent than the former, and continued for about six weeks; during which time he had three increased paroxysms, or distinct smart fits, which held him about two hours each; in the last of which he had the same critical discharge, by vomiting of the same corrosive matter, preceded by the same uncommon symptoms as in the fit of 1753. But mending every hour, he was able the very next day to walk, and attend his patients, with more ease than after the first mentioned fit; for the swelling abated much sooner, and in three days disappeared.

Podagra.

"I have said, that this last fit was attended with three distinct paroxysms, the last of which ended as above: yet to show the disposition of nature, in this case, to throw off the offending humour in this her new way, it is remarkable, that in the two first of these increased paroxysms of pain, the patient declared to me that he never had the least ease till he had vomited; but as there was no translation of the pain before these vomitings, there was none of that corrosive matter to be discharged; nothing but the common contents of the stomach was to be seen. These vomitings, however, procured the patient some ease; but the fit of the gout went on till the third paroxysm was over, which ended as has been related.

"As the crisis in this case is uncommon, I must take notice of a symptom or two, which were no less extraordinary, in both these fits of the gout.

"A most profuse sweat attended the patient every morning during the whole course of the fits; which was so very offensive, and at the same time his breath so uncommonly stinking, that neither the patient himself, nor those who waited on him, were ever sensible of the like.

"His linen was tinged as with saffron; and his urine very high coloured, of almost as deep a red as claret: but, upon the critical vomitings, every one of these symptoms disappeared with the disease.

"On the 9th of December 1755, he was attacked again in one foot. The symptoms, however, were so very mild, that he took no notice of them to his family till the 12th; from that day the pain was aggravated, and the swelling greatly increased, by walking and riding in a coach. On the 17th it became extremely violent, particularly in the heel; when it instantaneously left the parts affected, and in the same manner and with equal velocity (as in the two former fits), it flew into the calves of his legs, thighs, and abdomen; and when it had reached the stomach, it caused him to vomit the same kind of corrosive acid as in the two former fits; and though the quantity was no more than a tea-spoonful, he became perfectly well in two days.

"The same symptoms of fetid urine, and offensive sweats, attended the patient in this short paroxysm as in those of 1753 and 1754; the sweat continued but two nights, and the urine fetid only 48 hours.

"As Mr Rook had experienced so great and happy effects from the former critical vomitings, he was greatly disappointed upon finding the quantity evacuated so very small; for which reason he immediately attempted to increase it, by drinking three pints of warm water (which was at hand), but in vain; for neither that, nor the use of his finger, could provoke to an evacuation, which was begun and finished by nature: for though the quantity evacuated was so very small, yet as it was equally corrosive, and produced the same effect,

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effect, the discharge must be accounted as truly critical as the others were.

"During the first of these fits, in the year 1752, a hard tumor had appeared on the side of the metatarsus near the middle of the right foot, which continued till after the third critical vomiting; when it was resolved, and totally disappeared, upon the discharge of a viscid matter like the white of an egg, with a few small chalk-stones from the end of the middle toe of the same foot. This discharge happened about four or five days before the patient was seized with a regular fit in April 1755. But it is to be remarked, that this last fit continued three or four weeks, and went off in the common way, without any of the critical discharges of vomiting, urine or sweat; but left on one hand three, and on the other two, fingers loaded with chalk-stones; with this peculiar symptom, that when the weather was cold those fingers were affected with a most exquisite pain, which was always removed by heat.

"But not long after this last mentioned fit, a large quantity of chalk-stones were extracted from the bottom of the left foot, near the ball of the great toe, and that from time to time for about three or four months. On the 19th of January 1756 (the wound occasioned by the chalk-stones being still open), he was seized with a fever, without any symptom of the gout: the fever went off on the third day, with the same kind of critical sweat and urine as always accompanied the acid vomitings in the forementioned fits. On the fourth day from the attack of the fever, a fit of the gout came on, with the common symptoms, in both feet; which continued with violence for about a week, with frequent retching and vomiting, but without bringing up more than the common contents of the stomach. At this time an uncommon itching in the bottom of the foot and ball of the great toe from whence the chalk-stones had been extracted, tormented the patient for five or six hours; upon his gently rubbing the part, he was very sensible of a fluctuation of some matter, which soon appeared to flow at first in small quantities from the open orifice in the ball of the toe: upon pressing the part, about a tea-cup full of a liquid chalky matter was collected. The next morning the patient made a large opening with an imposthume knife, which produced more than half a pint of a bloody serous matter, full of chalk-stones, which proved as truly critical as the vomitings of the corrosive acid did in the cases abovementioned; for the orifice from whence the chalk-stones first issued, was very soon healed, and the gentleman continues in perfect health."

216 GENUS XXV. ARTHROPUOSIS.

Lumbago psoadica *Sauv.* sp. 6. *Fordyce*, Practice of Physic, P. II. p. 70.
Lumbago apostematosa, *Sauv.* sp. 12.
Lumbago ab arthrocace, *Sauv.* sp. 17.
Ischias ex abscessu, *Sauv.* sp. 6.
Morbus coxarius, *De Haen*, Rat. Med. Vol. I. c. xxxii.

THIS is a disease very much resembling the rheumatism; but differing both from it and the gout, in that it occasions suppurations, which they seldom or never do. It frequently, according to Sauvages, attacks the psoas muscle; and occasions excruciating pains, and then collections of matter.

Arthropuosis.

The only cure is, if suppuration cannot be prevented, to lay open the part where the matter is contained, which would otherwise be absorbed, and occasion a fatal hectic.

ORDER III. EXANTHEMATA. 217

Exanthemata, *Sag.* Class X.
Phlegmasiæ exanthematicæ, *Sauv.* Class III. Ord. I.
Morbi exanthematici, *Lin.* Class I. Ord. II.
Febres exanthematicæ, *Vog.* Class I. Ord. 2.

GENUS XXVI. ERYSIPELAS. 218
ST ANTHONY'S FIRE.

Erysipelas *Sauv.* gen. 97. *Lin.* 10. *Sag.* gen. 296.
Febris erysipelacea, *Vog.* 68. *Hoffm.* II. 98.

SP. I. ERYSIPELAS with *Blisters*. 219

Erysipelas rosa, *Sauv.* sp. 1. *Sennert de febr.* lib. ii. c. 15.
Febris erysipelatosa, *Sydenham*, sect. vi. cap. v.
Erysipelas typhodes *Sauv.* sp. 2.
Erysipelas pestilens, *Sauv.* sp. 5.
Erysipelas contagiosum, *Sauv.* sp. 9.

Description. The erysipelas of the face, where this affection very frequently appears, comes on with a cold shivering, and other symptoms of pyrexia. The hot stage of this is frequently attended with a confusion of the head, and some degree of delirium; and almost always with drowsiness, and perhaps coma. The pulse is always frequent, and commonly full and hard.—When these symptoms have continued for one two, or at most three days, an *erythema* appears on some part of the face. This at first is of no great extent, but gradually spreads from the part it first occupied to the other parts of the face, till it has affected the whole; and frequently from the face it spreads over the hairy scalp, or descends on some part of the cheek. As the redness spreads, it commonly leaves, or at least is abated in the parts it had before occupied. All the parts which the redness affects are also affected with some swelling, which continues for some time after the redness has abated. The whole face becomes considerably turgid; and the eye-lids are often so much swelled as entirely to shut up the eyes. When the redness and swelling have continued for some time, there commonly arise, sooner or later, blisters of a larger or smaller size on several parts of the face. These contain a thin colourless liquor, which sooner or later runs out. The surface of the skin in the blistered places, sometimes becomes livid and blackish; but this seldom goes deeper, or discovers any degree of gangrene affecting the skin. On the parts of the face not affected with blisters, the cuticle suffers, towards the end of the disease, a considerable desquamation. Sometimes the tumor of the eye-lids ends in a suppuration.

The inflammation coming upon the face does not produce any remission of the fever which had before prevailed; and sometimes the fever increases with the spreading and increasing inflammation. The inflammation

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tion commonly continues for eight or ten days; and, for the same time, the fever and symptoms attending it also continues. In the progress of the disease the delirium and coma attending it sometimes go on increasing, and the patient dies apoplectic on the seventh, ninth, or eleventh day of the disease. In such cases it has been commonly supposed, that the disease is translated from the external to the internal parts. But Dr Cullen thinks, that the affection of the brain is merely a communication from the external affection, as this continues increasing at the same time with the internal. When the fatal event does not take place, the inflammation, after having affected the whole face, and perhaps the other external parts of the head, ceases, and with that the fever also; and, without any other crisis, the patient returns to his ordinary health. This disease is not commonly contagious; but as it may arise from an acrid matter externally applied, so it is possible that the disease may sometimes be communicated from one person to another. Persons who have once laboured under this disease are liable to returns of it.

Prognosis. The event of this disease may be foreseen from the state of the symptoms which denote more or less the affection of the brain. If neither delirium nor coma come on, the disease is seldom attended with any danger; but when these symptoms appear early in the disease, and are in a considerable degree, the utmost danger is to be apprehended.

Cure. The erysipelas of the face is to be cured, according to the opinion of most practitioners, much in the same manner as phlegmonic inflammations; by blood-letting, cooling purgatives, and by employing every part of the antiphlogistic regimen. Many observations, however, would lead us to conclude, that in not a few cases the concomitant fever has here a tendency to the typhoid type; and therefore evacuations apparently serviceable in the first instance have afterwards a bad effect. The evacuations of blood-letting and purging are to be employed more or less according to the urgency of symptoms; particularly those which mark an affection of the brain. As the pyrexia continues, and often increases with the inflammation of the face, so the evacuations abovementioned are to be employed at any time of the disease. When, however, the fever, in place of marks of the phlogistic diathesis, particularly a full, hard, and strong pulse, is attended with symptoms of great debility, and with a small pulse easily compressible; evacuations, particularly under the form of blood-letting, must be used with very great caution. Even in such cases, however, the use of refrigerant cathartics may still be persisted in with more safety and greater advantage. But whether evacuants have been employed or not, when symptoms of debility run to a great height, and marks of putrescent tendency appear, recourse must be had to wine and the Peruvian bark. In cases which at the commencement require evacuation, these are often in the after periods employed with very great benefit.

In this, as in other diseases of the head, when that part happens to be the seat of erysipelas, it is proper to put the patient, as often as he can easily bear it, into somewhat of an erect posture; and as in this disease there is always an external affection, so various external application have been proposed to be made to the part affected; but almost all of them are of doubtful effect.

Erysipelas.

An erysipelas frequently appears on other parts of the body besides the face, and such other erysipelatous inflammations frequently end in suppuration; but these cases are seldom dangerous. At coming on they are sometimes attended with drowsiness, and even with some delirium; but this seldom happens, and these symptoms do not continue after the inflammation is formed; and Dr Cullen does not remember to have seen an instance of the translation of an inflammation from the limbs to an internal part; and though these inflammations of the limbs be attended with pyrexia, they seldom require the same evacuations as the erysipelas of the face.

Sp. II. ERYSIPELAS with *Phlyctenæ*. 220

Erysipelas zoster, *Sauv.* sp. 8.
Zona; Anglis, *The* SHINGLES, *Russel* de tab. gland. p. 124. Hist. 35.
Herpes zoster, *Sauv.* sp. 9.

THIS differs from the former in no other way than in being attended with an eruption of phlyctenæ or small watery bladders on several parts of the body.—The method of cure is the same.

GEN. XXVII. PESTIS, the PLAGUE. 221

Pestis, *Sauv.* gen. 91. *Lin.* 2. *Junk.* 78.
Febris pestilentialis, *Vog.* 33. *Hoffm.* II. 93.
Pestis benigna, *Sauv.* sp. 2. Pestis Massiliensis, Class III. Traité de la peste, p. 41. Ejusdem pestis, Cl. 5to Traité p. 228.
Pestis remittens, *Sauv.* sp. 9.
Pestis vulgaris, *Sauv.* sp. 1. Pestis Massil. Cl. ii. Traité, p. 38. Ejusd. Cl. iii. & iv. Traité, p. 225, &c. *Walcschmidt.* de peste Holsatica, apud *Halleri* Diss. Pract. tom. v. *Chenot.* de peste Transylvanica, 1755, 1759, *De Haen*, Rat. Med. pars xiv.
Pestis Egyptiaca, *Sauv.* sp. 11. *Alpin.* de Med. Egypt.
Pestis interna, *Sauv.* sp. 3. Pest. Massil. Cl. I. Traité, p. 37—224.

History. OF this distemper Dr Cullen declines giving any particular history, because he never saw it; from the accounts of other authors, however, he is of opinion, that the circumstances peculiarly characteristic of it, especially of its more violent and dangerous states, are, 1. The great loss of strength in the animal function, which often appears early in the disease. 2. The stupor, giddiness, and consequent staggering, which resembles drunkenness, or the headach and various delirium all of them denoting a great disorder in the functions of the brain. 3. Anxiety, palpitation, syncope, and especially the weakness and irregularity of the pulse, denoting a considerable disturbance in the action of the heart. 4. Nausea and vomiting, particularly the vomiting of bile, which shows an accumulation of vitiated bile in the gall-bladder and biliary ducts, and from thence derived into the intestines and stomach; and which denote a considerable spasm, and loss of tone in the extreme vessels on the surface

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surface of the body. 5. The buboes and carbuncles, which denote an acrimony prevailing in the fluids and, lastly, The petechiæ, hæmorrhages, and colliquative diarrhœa, which denote a putrescent tendency prevailing in a great degree in the mass of blood.

To these characteristics of the plague enumerated by Dr Cullen, we shall add one mentioned by Sir John Pringle, which though perhaps less frequent than the others, yet seems worthy of notice. It is this, That in the plague there is an extraordinary enlargement of the heart and liver. In nine dissections of bodies dead of the plague at Marseilles, this extraordinary enlargement of the heart is taken notice of in all of them, and of the liver in seven of them. The account was sent to the Royal Society by M. Didier, one of the physicians to the king of France, and has been published in the Philosophical Transactions. In the first case, the author takes notice, that "the heart was of an extraordinary bigness; and the liver was of double the natural size.—Case 2. the heart was of a prodigious bigness, and the liver much enlarged.—Case 3. The heart double the natural bigness.—Case 4. The heart was very large, and the liver was bigger and harder than ordinary.—Case 5. The heart was of a prodigious bigness.—Case 6. the heart was larger than in its natural state; the liver also was very large.—Case 7. the heart was of a prodigious size, and the liver was very large.—Case 8. The heart was much larger than natural, and the liver of a prodigious size.—Case 9. The heart was double the natural bigness, and the liver was larger than ordinary."—This preternatural enlargement Dr Pringle thinks is owing to the relaxation of the solid parts, by which means they become unable to resist the impetus of blood, and therefore are easily extended; as in the case of infancy, where the growth is remarkably quick. And a similar enlargement he takes notice of in the scurvy, and other putrid diseases.

A very elaborate work has lately been published on the subject of the plague by Dr Patrick Russel, formerly physician to the British factory at Aleppo. In this work, a very full history is given of the various forms and varieties of the disease. He makes particular observations on the following symptoms, which, in addition to the pestilential eruptions, he considers as the most important concomitants of plague, *viz.* fever, delirium, coma, inpediment or loss of speech, deafness, muddiness of the eyes, white tongue, state of the pulse, respiration, anxiety, pain at the heart, inquietude, debility, fainting, convulsion, appearances of the urine, perspiration, vomiting, looseness, and hæmorrhagy; and he concludes these remarks with some observations on the occurrence of the plague with pregnant women. To point out more distinctly the stable varieties of the disease, he arranges the pestilential cases which fell under his observation at Aleppo under six classes: and he concludes his description with a very minute and particular account of the pestilential eruptions, appearing under the form either of buboes, carbuncles, or other exanthemata. The presence of the two first, he observes either separtely or conjunctly, leaves the nature of the distemper unequivocal. But fatal has been the error of rashly pronouncing a distemper not to be a plague from their absence. Buboes affected the inguinal, axillary, parotid, maxillary, and cervical glands. But the first were the most commonly affected, and the two latter seldom observed to swell, without either the parotid swelling at the time or soon after. Of the carbuncles, Dr Russel describes five different varieties. The other exanthemata, which he observed sometimes, though less frequently, attending the plague, were petechiæ, a marbled appearance of the skin, an erysipelatous redness, streaks of a reddish purple or livid colour, vibices or weals, and large blue or purple spots, the *maculæ magnæ* of authors. In some cases, an extraordinary concurrence of eruptions took place, which was chiefly observed among children under 10 years of age.

Pestis.

Causes, &c. From a consideration of the symptoms abovementioned, Dr Cullen concludes, that the plague is owing to a specific contagion, often suddenly producing the most considerable debility in the nervous system or moving powers, and a general putrescency in the fluids. Dr Russel also considers the disease as being universally the consequence of what may be called *pestilential contagion;* and has judiciously repelled the objections which have been brought against this doctrine.

Prevention. Here we must refer to all those methods of preventing and removing the incipient contagion of putrid fevers, which have been so fully enumerated. Dr Cullen is persuaded that the disease never arises in the northern parts of Europe, but in consequence of being imported from some other country. The magistrate's first care therefore ought to be to prevent the importation; and this may generally be done by a due attention to bills of health, and to the proper performance of quarantines.—With respect to the latter, he is of opinion, that the quarantines of persons may with safety be much less than 40 days; and if this were allowed, the execution of the quarantine would be more exact and certain, as the temptation to break it would be in a great measure avoided. With respect to the quarantine of goods, it cannot be perfect unless the suspected goods be unpacked, duly ventilated, and other means be employed for correcting the infection they may carry; and if all this be properly done, it is probable that the time commonly prescribed for quarantine may be also shortened.

A second measure in the way of prevention is required, when an infection has reached and prevailed in any place, to prevent that infection from spreading into others. This can only be done by preventing the inhabitants or the goods of any infected place from going out of it till they have undergone a proper quarantine.

The third measure, and which ought to be employed with great care, is, to prevent the infection from spreading among the inhabitants of a place in which it has arisen. And in this case, a great deal may be done by the magistrate, 1. By allowing as many of the inhabitants as are free from infection, and are not necessary to the service of the place, to go out of it. 2. By discharging all assemblies, or unnecessary intercourse of the people. 3. By ordering some necessary communications to be performed without contact. 4. By making such arrangements and provisions

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visions as may render it easy for the families remaining to shut themselves up in their own houses. 5. By allowing persons to quit houses where an infection appears, upon condition that they go into lazarettoes. 6. by ventilating and purifying, or destroying, at the public expence, all infected goods. 7. By avoiding hospitals, and providing separate apartments for infected persons.

The fourth and last part of the business of prevention respects the conduct of persons necessarily remaining in infected places, especially those obliged to have some communication with persons infected. Those obliged to remain in places infected, but not to have any near communication with the sick, must avoid all near communication with other persons or their goods; and it is probable, that a small distance will serve, if, at the same time, there be no stream of air to carry the effluvia of persons or goods to some distance. Those who are obliged to have a near communication with the sick ought to avoid any of the debilitating causes which render the body susceptible of infection, as a spare diet, intemperance in drinking, excess in venery, cold, fear, or other depressing passions of the minds. A full diet of animal food is also to be avoided, because it increases the irritability of the body, and favours the operation of contagion; and indigestion, whether from the quantity or quality of the food, contributes very much to the same.

Besides these, it is probable that the moderate use of wine and spirituous liquors, moderate exercise, and the cold bath, may be of use; tonic medicines also, of which the Peruvian bark is deservedly accounted the chief, may likewise be used with some probability of success. If any thing is to be expected from antiseptics, Dr Cullen thinks camphor preferable to any other. In general, however, every one is to be indulged in the medicine of which he has the best opinion, provided it is not evidently hurtful. Whether issues be useful in preserving from the effects of contagion, is a matter of doubt. Dr Russel in his treatise enters very fully into the consideration of the means of prevention, both with respect to quarantines, lazarettoes, and bills of health. He is of opinion, that the present laws on these subjects are in many respects defective: and he thinks, that a set of new regulations would have the best chance of a deliberate and impartial discussion in the senate, if the inquiry were taken at a time free from all apprehension of immediate danger.

Cure. Here according to Dr Cullen, the indications are the same as in fever in general, but are not all equally important. The measures for moderating the violence of reaction, which operate by diminishing the action of the heart and arteries, have seldom, he thinks, any place here, excepting that the antiphlogistic regimen is generally proper. Some physicians have recommended bleeding, and Sydenham even seems to think it an effectual cure; but Dr Cullen supposes, that for the most part it is unnecessary, and in many cases might do much hurt. Dr Russel, however, who on this subject speaks from experience and actual observation, is of a different opinion. With most of his patients, a single bleeding was employed with advantage; and even where the sick under his inspection were bled oftener than once, he did not find that the low state was thereby hurried on. Purging has also been recommended; and in some degree it may be useful in drawing off the putrescent matter frequently present in the intestines; but a large evacuation this way may certainly be hurtful.

Pestis.

The moderating the violence of reaction, as far as it can be done, by taking off the spasm of the extreme vessels, is a measure, in Dr Cullen's opinion, of the utmost necessity in the cure of the plague; and the whole of the means formerly mentioned, as suited to this indication, are extremely proper. The giving an emetic, at the first approach of the disease, would probably be of great service; and it is probable that, at some other periods of the disease, emetics might be useful, both by evacuating bile abounding in the alimentary canal, and by taking off the spasm of the extreme vessels. Indeed Baron Ash, and some other of the Russian practitioners, represent the early and repeated use of emetics as the only effectual mode of cure.

From some principles with respect to fever in general, and with respect to the plague in particular, Dr Cullen is of opinion, that after the exhibition of the first vomit, the body should be disposed to sweat; but this sweat shold be raised only to a moderate degree, though it must be continued for 24 hours or more if the patient bears it easily. The sweating is to be excited and conducted according to the rules laid down under SYNOCHA; and must be promoted by a plentiful use of diluents rendered more grateful by vegatable acids, or more powerful by being impregnated with some portion of neutral salts. To support the patient under the continuance of the sweat, a little weak broth, acidulated with the juice of lemons, may be given frequently, and sometimes a little wine if the heat of the body be not considerable. If sudorific medicines are judged necessary, opiates will be found most effectual and safe; but they should not be combined with aromatics, and probably may be more effectual if joined with a portion of emetics and of neutral salts. But if, notwithstanding the use of emetics and sudorifics in the beginning, the disease should still continue, the cure must turn upon the use of means for obviating debility and putrescency; and for this purpose tonic medicines, especially the Peruvian bark, and cold drink, are the most proper. For the treatment of buboes and carbuncles, see the article SURGERY.

GENUS XXVIII. VARIOLA. 222
The SMALL-POX.

Variola, *Sauv.* gen. 92. *Lin.* 3. *Sag.* gen. 290.
Febris variolosa, *Vog.* 35. *Hoffm.* II. 49.
Variolæ, *Boerh.* 1371. *Junck.* 76.

Sp. I. *The Distinct SMALL-POX.* 223

Variola discreta benigna, *Sauv.* sp. 2.
Variolæ regulares discretæ, *Sydenh.* sect. iii. cap. 2.
Variolæ discretæ simplices, *Helvet.* Ob. sp. 1.
Variola discreta complicata, *Sauv.* sp. 2. *Helvet.* sp. 2.
Variolæ anomalæ, *Sydenh.* sect. iv. cap 6.
Variola discreta dysenteriodes, *Sauv.* sp. 4. *Sydenh.* sect. iv. cap. 1.
Variola discreta vesicularis, *Sauv.* sp. 5.
Variola discreta crystallina, *Mead* de variol cap. 2.

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Variola discreta verrucosa, *Sauv.* sp. 6. *Mead* ibid.
Variola discreta siliquosa, *Sauv.* sp. 7. *Friend* Oper. p. 358.
Variola discreta miliaris, *Sauv.* sp. 8. *Helvet.* Obs. sp. 3.

224 Sp. II. *The Confluent* SMALL-POX.

Variola confluens, *Sauv.* sp. 9.
Variolæ regulares confluentes, ann. 1667. *Sydenham*, sect. iii. cap. 2.
Variolæ confluentes simplices, *Helvet.* Obs. sp. 1.
Variola confluens crystallina, *Sauv.* sp. 10.
Variola japonica, *Kempfer.*
Vesiculæ divæ Barbaræ, *C. Pis*, Obs. 149.
Variola confluens maligna, *Helvet.* Obs. sp. 1.
Variola confluens cohærens, *Sauv.* sp. 11.
Variola confluens maligna, *Helvet.* sp. 2.
Variola confluens nigra, *Sauv.* sp. 12. *Sydenham*, sect. v. cap. 4.
Variola confluens maligna, *Helvet.* sp. 3.
Variola sanguinea, *Mead.* de variolis, cap. 2.
Variola confluens corymbosa, *Sauv.* sp. 13.
Variola confluens maligna, *Helvet.* sp. 4.

Description. In the distinct small-pox, the disease begins with a synocha or inflammatory fever. It generally comes on about mid-day, with some symptoms of a cold stage, and commonly with a considerable languor and drowsiness. A hot stage is soon formed, and becomes more considerable on the second and third day. During this course children are liable to frequent startings from their slumbers; and adults, if they are kept in bed, are disposed to much sweating. On the third day, children are sometimes affected with one or two epileptic fits. Towards the end of the third day the eruption commonly appears, and gradually increases during the fourth; appearing first on the face, and successively on the inferior parts, so as to be completed over the whole body on the fifth day. From the third day the fever abates, and against the fifth it entirely ceases. The eruption appears first in small red spots hardly eminent, but by degrees rising into pimples. There are generally but few on the face; but, even when more numerous, they are separate and distinct from one another. On the fifth or sixth day, a small vesicle, containing an almost colourless fluid, appears on the top of each pimple. For two days these vesicles increase in breadth only, and there is a small hollow pit in their middle, so that they are not raised into spheroidical pustules till the eighth day. These pustules from their first formation continue to be surrounded with an exactly circular inflamed margin, which when they are numerous diffuses some inflammation over the neighbouring skin; so as to give somewhat of a damask-rose colour to the spaces between the pustules. As the pustules increase in size, the face swells considerably if they are numerous on it; and the eye-lids particularly are so much swelled, that the eyes are entirely shut. As the disease proceeds, the matter in the pustules becomes by degrees more opaque and white, and at length assumes a yellowish colour. On the eleventh day the swelling of the face is abated, and the pustules seem quite full. On the top of each a darker spot appears; and at this place the pustule, on the 11th day, or soon after, is spontaneously broken, and a portion of the matter oozes out; in consequence of which the pustule is shrivelled, and subsides; while the matter oozing out dries, and forms a crust upon its surface. Sometimes only a little of the matter oozes out, and what remains in the pustule becomes thick and even hard. After some days, both the crusts and the hardened pustules fall off, leaving the skin which they covered of a brownish red colour; nor doth it resume its natural colour till many days after. In some cases where the matter of the pustules has been more liquid, the crusts formed from it are later in falling off, and the part they covered suffers some desquamation, which occasions a small hollow or pit in it.

On the legs and hands the matter is frequently absorbed; so that at the height of the disease, these pustules appear as empty as vesicles. On the 10th and 11th days, as the swelling of the face subsides, a swelling arises in the hands and feet; but which again subsides as the pustules come to maturity. When the pustules on the face are numerous, some degree of pyrexia appears on the 10th and 11th days; but disappears again after the pustules are fully ripened, or perhaps remains in a very slight degree till the pustules on the feet have finished their course; and it is seldom that any fever continues longer in the distinct small-pox. When the pustules are numerous on the face, upon the sixth or seventh day some uneasiness of the throat, with a hoarseness of the voice, comes on, and a thin liquid is poured out from the mouth. These symptoms increase with the swelling of the face; and the liquids of the mouth and throat becoming thicker are with difficulty thrown out; and there is at the same time some difficulty in swallowing, so that liquids taken in to be swallowed are frequently rejected or thrown out by the nose. But all these affections of the fauces are abated as the swelling of the face subsides.

In the confluent small-pox all the symptoms abovementioned are much more severe. The eruptive fever particularly is more violent; the pulse is more frequent and more contracted, approaching to that state of pulse which is observed in typhus. The coma is more considerable, and there is frequently a delirium. Vomiting also frequently attends, especially at the beginning of the disease. In very young infants epileptic fits are sometimes frequent on the first days of the disease, and sometimes prove fatal before any eruption appears, or they usher in a very confluent and putrid small-pox. But at the same time, it has been justly remarked by Dr Sydenham, and other accurate observers, that epileptic attacks more frequently precede distinct and mild than malignant and confluent small-pox. The eruption appears in the confluent more early on the third day, and it is frequently preceded or accompanied with an erysipetalous efflorescence. Sometimes the eruption appears in clusters, like the measles. When the eruption is completed, the pimples are always more numerous upon the face, and at the same time smaller and less eminent. Upon the eruption the fever suffers some remission, but never goes off entirely; and after the fifth or sixth day it increases again, and continues to be considerable throughout the remaining part of the disease. The vesicles formed on the

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the top of the pimples appear sooner; and while they increase in breadth, they do not retain a circular, but are every way of an irregular figure. Many of them run into one another, insomuch that very often the face is covered with one vesicle rather than with a number of pustules. The vesicles, as far as they are any way separated, do not arise to a spheroïdal form, but remain flat, and sometimes the whole of the face is of an even surface. When the pustules are in any measure separated, they are not bounded by an inflamed margin, but the part of the skin that is free from pustules is commonly pale and flaccid. The liquor that is in the pustules changes from a clear to an opaque appearance, and becomes whitish or brownish, but never acquires the yellow colour and thick consistence that appears in the distinct small-pox. The swelling of the face, which only sometimes attends the distinct small-pox, always attends the confluent kind; it also comes on more early, and arises to a greater height, but abates considerably on the tenth or eleventh day. At this time the pustules or vesicles break and shrivel; pouring out at the same time a liquor, which is formed into brown or black crusts, which do not fall off for a long time after. Those of the face, in falling off, leave the skin subject to a desquamation, which pretty certainly produces pittings. On the other parts of the body the pustules of the confluent small-pox are more distinct than on the face; but never acquire the same maturity and consistence of pus as in the properly distinct kind.—The salivation, which only sometimes attends the distinct small-pox, very constantly attends the confluent; and both the salivation and the affection of the fauces abovementioned are, especially in adults, in a higher degree. In infants a diarrhœa comes frequently in place of a salivation.

In this kind of small-pox there is often a very considerable putrescency of the fluids, as appears from petechiæ, from serous vesicles, under which the skin shews a disposition to gangrene, and from bloody urine or other hœmorrhages; all of which symptoms frequently attend this disease. In the confluent small-pox also, the fever, which had only suffered a remission from the eruption to the maturation, at or immediately after this period is frequently renewed again with considerable violence. This is what has been called the *secondary fever*, and is of various duration and event.

Causes, &c. It is evident, that the small-pox is originally produced by contagion; and that this contagion is a ferment with respect to the fluids of the human body, which assimilates a great part of them to its own nature; or, at least, we have every reason to believe that a small quantity of contagious matter introduced, is somehow multiplied and increased in the circulating fluids of the animal body. This quantity passes again out of the body, partly by insensible perspiration, and partly by being deposited in pustules: The causes which determine more of the variolous matter to pass by perspiration, or to form pustules, are probably certain circumstances of the skin, which determine more or less of the variolous matter to stick in it, or to pass freely through it. The circumstance of the skin, which seems to determine the variolous matter to stick in it, is a certain state of inflammation depending much on the heat of it: thus we have many instances of parts of the body, from being more heated, having a greater number of pustules than other parts. Thus parts covered with plasters, especially those of the stimulant kind, have more pustules than others. —Certain circumstances, also, such as adult age, and full living, determining to a phlogistic diathesis, seem to produce a great number of pustules, and *vice versa*. It is therefore probable, that an inflammatory state of the whole system, and more particularly of the skin, gives occasion to a greater number of pustules; and the causes of this may produce most of the other circumstances of the confluent small-pox, such as the time of eruption, the continuance of the fever, the effusion of a more putrescent matter, and less fit to be converted into pus, together with the form and other circumstances of the pustules.

Variola.

Prognosis. The more exactly the disease retains the form of the distinct kind, it is the safer; and the more completely the disease takes the form of the confluent kind, it is the more dangerous. It is only when the distinct kind shows a great number of pustules on the face or otherwise, by fever or putrescency, approaching to the circumstances of the confluent, that the distinct kind is attended with any danger.

In the confluent kind the danger is always very considerable; and the more violent and permanent the fever is, the greater the danger; and especially in proportion to the increase of the symptoms of putrescency. When the putrid disposition is very great, the disease sometimes proves fatal before the eighth day; but in most cases death happens on the eleventh, and sometimes not till the fourteenth or seventeenth.

Though the small-pox may not prove immediately fatal, the more violent kinds are often followed by a morbid state of the body, sometimes of very dangerous event. These consequences, according to Dr Cullen, may be imputed sometimes to an acrid matter produced by the preceding disease, and deposited in different parts; and sometimes to an inflammatory diathesis produced and determined to particular parts of the body.

Cure. The art of medicine hath never yet afforded a method of preventing the eruption of the small-pox after the contagion is received; all that can be done is, to render the disease more mild, which is generally effected by INOCULATION. It is not to be supposed that the mere giving of the infection artificially could make any difference in the nature of the disease, was it not that certain precautions are commonly used in the case of those who are inoculated, which cannot be used in the case of those who receive them naturally.—These measures, according to Dr Cullen, are chiefly the following. 225

1. The choosing for the subject of inoculation persons otherwise freed from disease, and not liable from their age or otherwise to any incidental disease.

2. The choosing that time of life which is most favourable to a mild disease.

3. The choosing for the practice a season most favourable to a mild disease.

4. The

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4. The preparing the perſon to be inoculated, by enjoining abſtinence from animal food for ſome time before inocculation.

5. The preparing the perſon by courſes of mercurial and antimonial medicines.

6. The taking care at the time of inoculation to avoid cold, intemperance, fear, or other circumſtances which might aggravate the future diſeaſe.

7. After theſe preparations and precautions, the chooſing a fit matter to be employed in inoculation, by taking it from a perſon of a ſound conſtitution and free from any diſeaſe, or ſuſpicion of it; by taking it from a perſon who has had the ſmall-pox of the moſt benign kind; and laſtly, by taking the matter from ſuch perſon as ſoon as it has appeared in the puſtules, either on the part inoculated, or on other parts of the body.

8. The introducing, by inoculation, but a ſmall portion of the contagious matter.

9. After inoculation, the continuing of vegetable diet, and the employment of mercurial and antimonial medicines, and at the ſame time employing frequent purging.

10. Both before and after inocculation, taking care to avoid external heat, either from the ſun, artificial fires, warm chambers, much clothing, or being much in bed; and on the contrary, expoſing the perſon to a free and cool air.

11. Upon the appearance of the eruptive fever, the rendering that moderate by the employment of purgatives; by the uſe of cooling and antiſeptic acids; and eſpecially by expoſing the perſon frequently to a cool and even a cold air, at the ſame time giving freely of cold drink.

12. After the eruption, the continuing the application of cold air, and the uſe of pugatives, during the courſe of the diſeaſe, till the puſtules are fully ripened.

On theſe meaſures Dr Cullen obſerves, that, as the common infection may often ſeize perſons under a diſeaſed ſtate, which may render the ſmall-pox more violent, it is evident that inoculation muſt have a great advantage by avoiding ſuch concurrence. But as the avoiding of this may in the mean time frequently leave perſons expoſed to the common infection, it is well worth while to enquire what are the diſeaſed ſtates which ſhould reſtrain from the practice of inoculation. This is not yet ſufficiently aſcertained; for it hath been obſerved, that the ſmall-pox has often occurred with a diſeaſed ſtate of the body, without being thereby rendered more violent; and it hath alſo been obſerved, that ſome diſeaſes of the ſkin are equally innocent. Dr Cullen is of opinion that they are diſeaſes of the febrile kind, or ſuch ailments as induce or aggravate a febrile ſtate, that eſpecially give the concurrence which is moſt dangerous with the ſmall-pox. He is alſo of opinnion, that though a perſon be in a diſeaſed ſtate, if that ſtate be of uncertain nature and effect, and at the ſame time the ſmall-pox are very common in the neigbourhood, ſo that it muſt be extremely difficult to guard againſt the common infection it will always be ſafer to give the ſmall-pox by inoculation than to leave the perſon to take them by the common infection.

Variola.

Though inoculation has been practiſed with ſafety upon perſons of all ages, yet there is reaſon to conclude, that adults are more liable to a violent diſeaſe than perſons of younger years. At the ſame time it is obſerved, that children, in the time of their firſt dentition, are liable, from the irritation of that, to have the ſmall-pox rendered more violent; and that infants, before the time of dentition, upon receiving the contagion of the ſmall-pox, are liable to be afflicted with epileptic fits, which frequently prove fatal. Hence it is evident, that though circumſtances may admit and approve of inoculation at any age, yet for the moſt part it wil be advantageous to chooſe perſons after the firſt dentition is over, and before the time of puberty. But in large cities in particular, if the operation be delayed till after dentition, the patient muſt run many riſks of accidental infection, and thus many will be cut off by the natural ſmall-pox who might have been ſaved by more early inoculation. Accordingly, in towns eſpecially, it is now the common practice to inoculate infants when only three or four months old; and indeed accidents ſo rarely happpen, that it is almoſt impoſſible to conceiv ethat greater ſucceſs can be obtained at any other period of life.

The operation of inoculation may be performed at any ſeaſon of the year; yet as it is certain that the cold of winter may increaſe the inflammatory, and the heats of ſummer increaſe the putreſcent, ſtate of the ſmall-pox it is highly probable that inoculation may have ſome advantage from avoiding the extremes either of cold or heat.

As the uſe of animal-food may increaſe both the inflammatory and putreſcent ſtate of the human body ſo it muſt render perſons, in receiving the contagion of the ſmall-pox, leſs ſecure againſt a violent diſeaſe; and therefore inocculation may derive ſome advantage by enjoining abſtinence from animal-food for ſome time before the operation is performed; But Dr Cullen is of opinnion, that a longer time is neceſſary than what is commonly preſcribed.

Mercurial and antimonial preparations may have ſome effect in determining to a more free perſpiration and therefore may be of ſome uſe in preparing a perſon for the ſmall-pox; but there are many obſervations which render their uſe doubtful. The quantity of both theſe medicines, particularly the antimony, commonly employed, is too inconſiderable to have any effects. Mercurials indeed have been often employed more freely; but even their ſalutary effects have not been evident, and they have ſometimes been manifeſtly productive of miſchief. It is therefore much to be doubted, whether inoculation really derives any benefit from theſe preparatory courſes or not.

It has been often obſerved, in the caſe of almoſt all contagions, that cold, intemperance, fear, and ſome other circumſtances, concurring with the application of the contagion, have greatly aggravated the future diſeaſe; it muſt undoubtedly be the ſame in the caſe of the ſmall-pox: and it is certain that inoculation muſt derive a great advantage, perhaps its principal one, from avoiding the concurrences above mentioned.

It has commonly been ſuppoſed, that inoculation derives ſome advantage from the choice of the matter employed in it; but it is very doubtful if any choice

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be here neceſſary, or can be of any benefit in determining the ſtate of the diſeaſe. It is not indeed probable that there is any difference of contagion producing the ſmall-pox; for there are innumerable inſtances of the contagion, ariſing from a perſon who labours under the diſtinct ſmall-pox producing the confluent kind, and the contrary. Since the practice of inoculation hath been introduced, it has alſo been obſerved that the ſame variolous matter would in one perſon produce the diſtinct and in another the confluent ſmall-pox. It is therefore highly probable, that the difference of the ſmall-pox does not much depend upon any difference of the contagion, but upon ſome difference in the ſtate of the perſons to whom it is appplied, or in the ſtate of certain circumſtances concuring with the application of the contagion.

Some have ſuppoſed, that inocnlation has an advantage over the natural infection, by introducing only a ſmall portion of contagious matter into the body; but this is by no means well aſcertained. It is not known what quantity of contagion is introduced into the body by the common infection of the ſmall-pox; and it is probable the quantity is not great; nor, though it were larger than that thrown in by inoculation; is it certain what the effects would be. A certain quantity of ferment may be neceſſary to excite fermentation in a given maſs; but when that quantity is given the fermentation and aſſimilation are extended to the whole maſs; and we do not find that a greater quantity than is juſt neceſſary, either increaſes the activity of the fermentation, or more certainly ſecures the aſſimilation of the whole. In the caſe of the ſmall-pox a conſiderable difference in the quantity of the contagion introduced hath not ſhown any effects in modyfying the diſeaſe.

Purging has the effect of diminiſhing the activity of the ſanguiferous ſyſtem, and of obviating the inflammatory ſtate of it; and therefore it is probable; that the frequent uſe of cooling purgatives gives a conſiderable advantage to the practice of inoculation and probably this is alſo obtained by diminiſhing the determination to the ſkin. It ſeems alſo probable, that mercurials and antimonials are uſeful only as they make part of the purging courſe.

It is probable that the ſtate of the ſmall-pox depends very much upon the ſtate of the eruptive fever, and particularly in avoiding the inflammatory ſtate of the ſkin; and therefore it is alſo probable, that the meaſures taken for moderating the eruptive fever, and inflammatory ſtate of the ſkin, are the greateſt improvement which has been made in the practice of inoculation. The tendency of purging, and the uſe of acids to this purpoſe, is ſufficiently obvious; and upon the ſame grounds we ſhould ſuppoſe that blood-letting might be uſeful; but probably this has been omitted, and perhaps other remedies might be ſo, ſince we have found a more powerful and effectual one in the application of cold air and the uſe of cold drink.

It hath been the practice of inoculators to continue the uſe of purgatives and the application of cold air after the eruption; but it cannot be ſaid to give any particular advantages to inoculation, and the employment of purgatives ſeems often to have led to an abuſe. When the ſtate of the eruption is determined, when the number of puſtules is very ſmall, and the fever has entirely ceaſed, the ſafety of the diſeaſe may be ſaid to be aſcertained, and further remedies abſolutely ſuperfluous: in ſuch caſes therefore the uſe of purgatives is unneceſſary, and may be hurtful.

Variola.

It remains now only to conſider the treatment of the ſmall-pox, when the ſymptoms are violent, as may ſometimes happen, even after inoculation and every remedy and precaution have been uſed. The cauſe of this is not aſcertained, but it ſeems to be a putreſcent tendency of the fluids. When therefore, from the prevailing of ſmall-pox as an epidemic, and more eſpecially when it is known that a perſon not formerly affected with the diſeaſe has been expoſed to the infection if ſuch perſon ſhould be attacked with the ſymptoms of fever, there can be little doubt that it is the fever of the ſmall-pox, and therefore he is to be treated in every reſpect as if he had received the diſeaſe by inoculation. He is to be freely expoſed to cool air, to be purged, and to have cooling acids given liberally. If theſe meaſures moderate the fever, nothing more is neceſſary: but if the nature of the fever be uncertain; or if, with ſuſpicions of the ſmall-pox, the fever be violent; or even if, knowing the diſtemper to be the ſmall-pox, the meaſures abovementioned do not moderate the fever ſufficiently; veneſection will be proper; and more eſpecially if the perſon be an adult, of a plethoric habit, and accuſtomed to full living. in the ſame circumſtances it will always be proper to give a vomit; which is uſeful in the beginning of all fevers, and eſpecially in this, where a determination to the ſtomach appears by pain and ſpontaneous vomiting.

It frequently happens, eſpecially in infants, that, during the eruptive fever of the ſmall-pox, convulſions occur. Of theſe, if only one or two fits appear on the evening preceding the eruption, they give a prognoſtic of a mild diſeaſe, and require no remedy; but if they occur more early, are violent, and frequently repeated, they are very dangerous, and require a ſpeedy remedy; and here bleeding and bliſtering are of no ſervice, the only effectual medicine is an opiate given in a large doſe.

Theſe are the remedies neceſſary during the eruptive fever; and if upon the eruption, the puſtules on the face are diſtinct, and their number few, the diſeaſe requires no further remedies. But when, upon the eruption, the number of pimples on the face is conſiderable, when they are not diſtinct, and eſpecially if, upon the fifth day, the fever does not ſuffer a conſiderable remiſſion; the diſeaſe ſtill requires a great deal of attention.

If, after the eruption, the fever ſhall ſtill continue the avoiding of heat and the continuing to expoſe the body to a cool air will ſtill be proper. If the fever be conſiderable, with a full hard pulſe, in an adult perſon, a bleeding will be neceſſary, and more certainly a cooling purgative; but it will be ſeldom neceſſary to repeat the bleeding, as a loſs of ſtrength very ſoon comes on; but the repetition of a purgative, or the frequent uſe of laxative glyſters, is commonly advantageous.

When a loſs of ſtrength, with other marks of a putreſcent tendency of the fluids, appears, the Peruvian bark muſt be given in ſubſtance, and in large quantity,

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quantity. In the ſame caſe, the uſe of acids and of nitre is advantageous, and commonly it is proper alſo to give wine very freely. From the fifth day of the diſeaſe throughout the whole courſe of it, it is proper to give an opiate once or twice a day; taking care at the ſame time to obviate coſtiveneſs, by purgatives or by laxative glyſters. From the eighth to the eleventh day of a violent diſeaſe, it will be proper to lay on bliſters ſucceſſively on different parts of the body, and that without regard to the parts being covered with puſtules. Bliſters are alſo to be applied to the external fauces, in caſe of difficult deglutition, and viſcid ſaliva and mucus, which are thrown out with difficulty, at the ſame time that detergent gargles are to be diligently uſed. During the whole courſe of this diſeaſe, when a conſiderable fever is preſent, antimonial medicines, in nauſeating doſes, have by ſome been alleged to be employed with advantage; and in this way they have often the effect of moving the belly. But the great diſtreſs which patients ſuffer from a ſtate of conſtant naufea is hardly to be borne; and every advantage which can be had from this practice may be obtained by eaſier means.

The remedies abovementioned are frequently proper from the fifth day till the ſuppuration be finiſhed. But after that period the fever is ſometimes continued and increaſed; or ſometimes, when there was little or no fever before, a fever now ariſes and continues with conſiderable danger; this is called the *ſecondary fever*, and requires a particular treatment.

When the ſecondary fever follows the diſtinct ſmall-pox, and the pulſe is full and hard, the caſe is to be treated as an inflammatory affection, by bleeding and purging; but the ſecondary fever which follows the confluent kind is to be conſidered as a putrid diſeaſe and bleeding is improper. Some purging may be neceſſary, but the remedies chiefly to be depended upon are the Peruvian bark and acids. When the ſecondary fever firſt appears, whether after a diſtinct or confluent ſmall-pox, it is uſeful to exhibit an antimonial emetic in nauſeating doſes, but in ſuch a manner as to produce ſome vomiting. For avoiding the pits which frequently follow the ſmall-pox, no method hitherto propoſed ſeems to be ſufficiently certain.

On the ſubject of inoculation, Baron Dimſdale, a very celebrated writer, informs us, that were it left to his choice, he would decline inoculating children under two years old; becauſe within that period they are expoſed to all the dangers of dentition, fevers, fluxes, convulſions, and other accidents, ſufficiently difficult in themſelves to manage in ſuch tender ſubjects.

In regard to conſtitution, Baron Dimſdale obſerves, that greater liberties may be taken than were formerly judged admiſſible. Perſons afflicted with various chronic complaints, of ſcrophulous ſcorbutic and arthritic habits; perſons of unwieldy corpulency, and of intemperate irregular lives; have all paſſed through this diſeaſe with as much facility as the moſt temperate healthy, and regular. But thoſe who labour under any acute or critical diſeaſe, or its effects, are obviouſly unfit and improper ſubjects. So likewiſe are thoſe in whom are evident marks of corroſive acrimonious humours, or who have an evident debility of the whole frame from inanition or any other cauſe. All ſuch require to be treated in a particular manner previous to the introduction of this diſeaſe. Conſtitutions diſpoſed to frequent returns of intermittents, ſeem likewiſe juſtly exceptionable; eſpecially as the preparatory regimen may in ſome habits increaſe this tendency. Baron Dimſdale, however, has known inſtances of ſevere ague-fits attacking perſons between the inſertion of the matter and the eruption of the ſmall-pox, and even during maturation, when the Peruvian bark has been given liberally and with much ſucceſs; the principal buſineſs, in the mean time, ſuffering no injury or interruption.

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Among the circumſtances generally conſidered as more or leſs propitious to inoculation, the ſeaſon of the year has been reckoned a matter of ſome importance, Spring and autumn have been generally recommended, as being the moſt temperate ſeaſons; the cold of winter and the ſummer heats having been judged unfavourable for this purpoſe. But Baron Dimſdale remarks, that experience does not juſtify thoſe opinions; for, according to the beſt obſervations he has been able to make, inoculated perſons have generally had more puſtules in ſpring than at any other time of the year; and epidemic diſeaſes being commonly moſt frequent in autumn, eſpecially fluxes, intermittents, and ulcerated ſore throats (all which are liable to mix more or leſs with the ſmall-pox), the autumn, upon this account does not ſeem to be the moſt favourable ſeaſon in general.

Baron Dimſdale's opinion is, that conſidering the ſurpriſing and indiſputable benefits ariſing at all times to patients in the ſmall-pox, from the free admiſſion of freſh cool air and evacuations, we may ſafely inoculate at all ſeaſons, provided care be taken to ſcreen the patients as much as poſſible from heat in ſummer, and to prevent them from keeping themſelves too warm and too much ſhut up, as they are naturally diſpoſed to do, from the weather in winter. When ſeaſons, however, are marked with any peculiar epidemics, of ſuch a kind eſpecially as may render a mild diſeaſe more untractable, it may perhaps be moſt prudent not to inoculate while ſuch diſeaſes are prevalent.

In directing the preparatory regimen, Baron Dimſdale principally aims at the following points, viz. To reduce the patient, if in high health, to a lower and more ſecure ſtate; to ſtrengthen the conſtitution, if too low; to correct what appears vitiated; and to clear the ſtomach and bowels as much as may be, from all crudities and their effects. With this view he orders ſuch of his patients as conſtitute the firſt claſs abovementioned, and who are by much the majority, to live in the following manner: To abſtain from all animal food, including broths, and likewiſe butter, and cheeſe, from all fermented liquors, excepting ſmall-beer, which is allowed ſparingly; and from all ſpices, and whatever is endued with a manifeſt heating quality. The diet is to conſiſt of pudding, gruel, ſago, milk, rice-milk, fruit-pyes, greens, roots, and vegetables of any of the kinds in ſeaſon, prepared or raw. Eggs, though not to be eaten alone, are allowed in puddings, and butter in pye-cruſt. The patients are to be careful that they do not eat ſuch a quantity as to overload their ſtomachs, even of this kind of food. Tea, coffee, or chocolate, are permitted for breakfaſt, to thoſe who chooſe or are accuſtomed to them.

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In this manner they are to proceed about nine or ten days before the operation; during which period, at nearly equal distances, they are directed to take three doses of the following powder, either made into pills or mixed with a little syrup or jelly, at bedtime, and a dose of Glauber's salts dissolved in thin water-gruel, each succeeding morning.

The powder is composed of eight grains of calomel, the same quantity of the compound powder of crab's claw's, and one eighth part of a grain of emetic tartar. Instead of the latter, Baron Dimsdale has sometimes substituted two grains of precipitated sulphur of antimony. In order to facilitate the division of the doses, a large quantity is prepared at once, and great care taken that the several ingredients be well mixed.

This quantity is usually sufficient for a healthy strong man; and the dose must be lessened for women or children, according to their age and strength, as well as for persons advanced in years.

The first dose is generally ordered at the commencement of the course; the second three or four days after; and the third about the eighth or ninth day. The Baron chooses to inoculate the day after the last dose has been taken. On the days of purging, broths are to be allowed, and the patients are desired to abstain from unprepared vegetables.

What has been said concerning the preparation, must be considered as proper only for the young or middle-aged, in a good state of health: but among those who are desirous of inoculation, are often found tender, delicate, and weakly women; men of bad stamina, valetudinarians by constitution, by illness, or intemperance; also aged persons, and children; and for all such a very different treatment must be directed. Here a milder course of medicine, rather of the alterative than purgative kind, is preferable; and in many instances, an indulgence in some light animal-food, with a glass or two of wine in case of lowness, is not only allowable, but necessary to support a proper degree of strength, especially in advanced age.

Children, whose bowels are often tender, and ought not to be ruffled by strong purges, yet require a mild mercurial and bear it well. Besides emptying the bowels of crudities, it is a good security against worms and their effects, which sometimes produce very alarming and even fatal disorders.

Inattention to the particular state of health of those who are entering upon the preparatory course, has been productive of great mischief. This is chiefly observable respecting the indiscreet use of mercurials, by which a salivation has often been raised, to the risk of impairing good constitutions, and the ruin of such as were previously weak and infirm. The distinctions and treatment necessary, will be obvious to those who are acquainted with the animal economy and medical practice.

The time of menstruation has generally been the guide in respect to the inoculation of women, that the whole of the disease may be over within the menstrual period. Baron Dimsdale informs us, that he observes this rule, when he can choose his time without any inconvenience, and he inoculates soon after the evacuation ceases; though he has no reason to decline performing the operation at any time.

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Women with child have likewise been inoculated, and done well; but the state of pregnancy seems unfavourable to the process, which ought therefore not to be hazarded without some urgent reason. Baron Dimsdale has not inoculated any woman whom he knew to be pregnant; but on some who concealed their pregnancy he has performed the operation, without producing a miscarriage; the hope of which event, he suspects, had rendered them desirous of the process. One of those had a child born nine weeks after inoculation at the full time, with distinct marks of the disease, though the mother had very few pustules.

The manner most commonly practised in Britain for communicating the small-pox by inoculation, has of late been the following: a thread was drawn thro' a ripe pustule, and well moistened with matter. A piece of this thread was insinuated into a superficial incision made in one or both arms, near the part where issues are usually fixed; and being covered with a a plaster, was three left for a day or two.

Very different methods of inoculation, however, are pursued; two of which Baron Dimsdale has frequently practised and describes; but he informs us, that the following has proved so invariably successful, as to induce him to give it the preference.

The patient to be infected being in the same house, and if no objection be made to it, in the same room, with one who has the disease, a little of the variolous matter is taken from the place of insertion, if the subject be under inoculation; or a pustule, if in the natural way, on the point of a lancet, so that both sides of the point are moistened.

With this lancet an incision is made in that part of the arm where issues are usually placed, deep enough to pass through the scarf-skin, and just to touch the skin itself; and in length as short as possible, not more than one eighth of an inch.

The little wound being then stretched open between the finger and thumb of the operator, the incision is moistened with the matter, by gently touching it with the flat side of the infected lancet. This operation is generally performed in both arms, and sometimes in two places in one arm, a little distant from each other. For as Baron Dimsdale has not observed any inconvenience from two or three incisions, he seldom trusts to one; that neither he nor his patient may be under any doubt about the success of the operation from its being performed in one place only.

Baron Dimsdale has also tried the following method, with the same success as that above described; but he does not so much approve of it, because he has been credibly informed that it has sometimes failed in the practice of others. A lancet being moistened with the variolous fluid in the same manner as in the other, is gently introduced, in an oblique manner, between the scarf and true skin, and the finger of the operator is applied on the point, in order to wipe off the infection from the lancet, when it is withdrawn. In this method, as well as in the former, a little blood will sometimes appear; but Baron Dimsdale neither draws blood with design, nor does he think there is any necessity of wiping it off before the matter is introduced.

In both these ways of inoculating, neither plaster, bandage,

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bandage, nor covering is applied, nor in any respect necessary.

Baron Dimsdale informs us, that those methods of producing this disease have never once failed him; and experience has sufficiently proved that there is no danger from additional infection by the natural disease at the same time. He therefore makes no scruple of having the person to be inoculated, and the person from whom the infection is to be taken, in the same room; nor has he ever observed any ill consequence attending this practice. But he advises the inoculated patients (though perhaps there be no necessity for that precaution) to be afterwards separated from places of infection till certain signs of success appear, when all restraint is removed, there being then no danger from accumulation.

Baron Dimsdale remarks, that it seems to be of no consequence whether the infecting matter be taken from the natural or inoculated small-pox. He has used both, and never has been able to discover the least difference, either respecting the certainty of infection, the progress, or the event. He therefore takes the infection from either, as opportunity offers, or at the option of the patients or their friends.

Neither is it of any consequence whether the matter be taken before, or at the crisis of, the distemper. It is generally supposed, that the small-pox is not infectious till after the matter has acquired a certain degree of maturity; and in the common method of inoculation this is so much attended to, that when the operation has proved ineffectual, the failure has been ascribed to the unripeness of the matter.

But, as the author remarks, it appears very clearly from the present practice of inoculation, that so soon as any moisture can be taken from the infected part of an inoculated patient, previous to the appearance of any pustules, and even previous to the eruptive fever, this moisture is capable of communicating the small-pox with the utmost certainty. Baron Dimsdale has taken a little clear fluid from the elevated pellicle on the incised part, even so early as the fourth day after the operation; and has at other times used matter fully digested at the crisis, with equal success. In general, however, he prefers taking the matter for infection during the eruptive fever, as he supposes it at that time to have its utmost activity.

In all cases, when he takes matter from an inoculated person, it is from the place where it was inserted; as he is always sure to find infection there if the disease succeeds, and always of sufficient energy.

It may appear strange that no bandage, dressing, or application whatsoever, is used to the part infected; but that the most simple incision being made, and moistened with the smallest particle of the recent fluid matter, the whole is committed to nature. This method, however, the Baron observes, is perfectly right: because the application of either plaster or unguent, as is the usual practice, will occasion an inflammation on some skins; and, in all, tend to disfigure the natural appearance of the incision, and prevent our forming a proper judgment of the progress of the infection.

If neither an inoculated patient be at hand, nor any one in the neighbourhood has a distinct kind of the natural disease, a thread may be used as in the common manner, provided it be very recently infected; but Baron Dimsdale is of opinion, that the thread ought to be used as soon as possible after being charged with the infecting matter.

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The method of inoculation recommended by Baron Dimsdale is now almost universally adopted; or at least if any change has taken place, the operation is, if possible, still more simplified. Without the trouble of bringing to the same house both the person from whom the contagion is to be taken and the person to whom it is to be given, the operator in general carries the matter about with him on what is called a *reservoir lancet*. For this purpose a common lancet may be employed; but one, the blade of which is accurately inclosed in a metallic case, so constructed as to prevent the access of the air, and at the same time not to rub off the matter, is certainly preferable. The infectious matter on this lancet is gently moistened by holding it for a few seconds over the steam of warm water; and by rubbing on it the point of another lancet, as much is taken off as is sufficient for giving the disease, which is done by introducing this infected point under the scarf-skin, in the manner Baron Dimsdale has recommended. Where fresh matter can be had, it is always preferable; but where this cannot be obtained, a lancet may be infected from a dry pustule, though kept for many months, by moistening it in warm water; particularly if care has been taken to preserve it from the action of external air by keping it in a close phial.

A due attention to the progress of infection, discoverable by the part where the operation was performed, is a necessary circumstance; because a just prognostic may thence be sometimes formed of the future state of the distemper, and indications may be taken from the different appearances on the arm, that will enable us to prevent inconveniences.

Baron Dimsdale observes, that the former method of covering the place of incision with a plaster, and continuing upon it dressings of one sort or other, prevented much useful information of this kind. They precluded any judgment by the touch, and sometimes rendered that by the eye equivocal.

The day after the operation is performed, though it takes effect, little alteration is discoverable. On the second day, if the part be viewed with a lens, there generally appears a kind of orange-coloured stain about the incision, and the surrounding skin seems to contract. At this time Baron Dimsdale usually gives the following medicine at going to bed, either mixed with a little of any kind of jelly, or more frequently made into a pill.

Calomel, and compound powder of crab's-claws, of each three grains; emetic tartar, one-tenth of a grain.

A quantity of this medicine should be carefully prepared at once, in order to make the division more exact.

On the fourth or fifth day, upon applying the finger, a hardness is perceptible to the touch. The patient feels an itching on the part, which appears slightly inflamed; and under a kind of vesication is seen a little clear fluid, the part resembling a superficial burn. About the sixth, most commonly some pain and stiffness is felt in the axilla; a circumstance which not only foretels the near approach of the eruptive symptoms, but

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but is a sign of a favourable progress of the disease. Sometimes on the seventh, oftener on the eighth day, symptoms of the eruptive fever appear; such as slight remitting pains in the head and back, succeeded by transient shivering and alternate heats, which continue in a greater or less degree till the eruption be perfected. At this time also it is usual for the patient to complain of a very disagreeable taste in his mouth, the breath is always fetid, and there ensues a smell peculiar to the variolous eruptive fever.

The inflammation in the arms at this time spreads fast; and, upon viewing it with a good glass, the incision for the most part appears surrounded with an infinite number of small confluent pustules, which increase in size and extent as the disease advances. On the tenth or eleventh day, a circular or oval efflorescence is usually discovered surrounding the incision, and extending sometimes near half round the arm, but more frequently to about the size of a shilling; and being under the cuticle, is smooth to the touch and not painful. This appearance also is favourable. It accompanies eruption; every disagreeable symptom ceases; and at the same time it certainly indicates the whole affair to be over, the pain and stiffness in the axilla also going off.

The feverish symptoms are for the most part so mild, as seldom to require any assistance, except a repetition of the same medicine that was directed on the second night after the operation; and next morning the following laxative draught should be given, to procure three or four stools.

Infusion of senna two ounces, manna half an ounce, tincture of jalap two drachms.

These are given as soon as the eruptive symptoms are perceivable, if they seem to indicate any uncommon degree of vehemence.

It has been observed, that by attending to the progress of infection, we may in general be able to prognosticate with some degree of certainty the issue of the distemper. Particular incidents will ever happen, but not sufficient to invalidate the propriety of general rules.

If the appearances already described are observed early, a very favourable event may be expected; but it happens in some cases, that the success of the inoculation is barely perceptible, the colour about the wound remaining pale, instead of changing to red or inflamed; the edges of the incision spread but little, they remain almost entirely flat, and are attended neither with itching nor uneasiness of any kind. Nay, sometimes on the fifth, and even the sixth day, the alteration is so little as to render it doubtful whether the infection has taken place.

When matters are in this state, Baron Dimsdale observes the appearance is unfavourable, implying a late and more untoward disease: To prevent which, he directs the powder or pill to be taken every night; and in case it fails to operate by stool, or there be the least disposition to costiveness, an ounce of Glauber's salts, or more commonly the laxative draught already mentioned, is given in the morning, once or twice, as the case may require. This course forwards the inflammation, which is always a desirable circumstance; it being in general observed, that an early progress on the arm, and an early commencement of the eruptive complaints, portend that the distemper will be mild and favourable; and on the contrary, when both are late, the symptoms he tells us are usually more irregular and unfavourable.

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Further experience, however, has by no means fully confirmed his oponion in this particular. On the contrary, even where the progress of infection in the arm has been uncommonly slow, a disease in the mildest possible form has succeeded. There is therefore no good reason why a practitioner should be alarmed at an uncommonly slow progress, or should in such instances employ more internal remedies than he would do in other cases. And some, whose practice in inoculation has been very extensive, have even remarked, that when infants are inoculated, they have never observed epileptic accessions, the most alarming forerunners of the disease, in those cases where the progress of the arm has been slow.

The management recommended by Baron Dimsdale at the period of eruption differing essentially from that of former practitioners, and being a matter of great importance, he gives the following explicit directions on this head, advising that they may be pursued with firmness and moderation.

Instead of the patient being confined to his bed or his room, when the symptoms of the eruptive fever come on, he is directed, as soon as the purging medicine has operated, to keep abroad, as much as he can bear, in the open air, be it ever so cold; always taking care not to stand still, but to walk about moderately while abroad. He is also directed, if thirsty, to drink cold water.

Baron Dimsdale observes, that this treatment seems as hard at first to the patients as it must appear singular to those who are unacquainted with such practice; but the effects are so salutary, so constantly confirmed by experience, and an easy progress through every stage of the disease depends so much upon it, that he admits of no exception, unless the weather be extremely severe and the constitution very delicate. He adds, it is indisputably true, that, in the few instances where the symptoms of eruption have run very high, the patients being averse to any motion, and fearing the cold as the greatest evil; yet when, under those circumstances, he has persuaded them to rise out of bed, and go out of doors, though led sometimes by two assistants, and has allowed them to drink as much cold water as they chose, they have not suffered the least unfavourable accident: on the contrary, after they have been prevailed upon to comply with those directions, they find their spirits revived; an inclination for nourishment returns; they rest well; a gentle sweat succeeds, accompanied with a favourable eruption; and the fever seems to be entirely extinguished.

Cool regimen during the eruptive fever is now almost universally adopted; but like other useful remedies it has not unfrequently been abused: And practitioners ought never to forget, that inoculated patients are not, more than the rest of the human species, exempted from injuries from cold, which is unquestionably a powerful cause of disease. Unless, therefore, in cases where very considerable morbid heat is induced by the eruptive fever, by which a temporary defence is unquestionably afforded against the action of external

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external cold, the bad effects which may result from it are never to be overlooked. And there is even reason to believe, as may indeed be inferred from Baron Dimsdale's observations, that the disease is more moderated by the action of pure and free air than by cold. Accordingly inoculation is performed with very great success even in the warmest seasons and situations of warm climates.

In general, the complaints in this state are very moderate, and attended with so little illness that the patient eats and sleeps well the whole time. A few pustules appear, sometimes equally disposed; sometimes the inflammations on the arms spread, and are surrounded with a few pustules, which gradually advance to maturity; during which time, for the most part, the eruption proceeds kindly, and there is much more difficulty to restrain the patients within due bounds, and prevent their mixing with the public, thereby spreading the infection, than there was at first to prevail upon them to go abroad. During this time medecine is seldom wanted; the coolest air seems the best cordial; and if any uncommon languor happens, a bason of small broth, or a glass of wine, is allowed in the day, or some white-wine whey at bed-time; which are indeed at any time allowed to tender, aged or weakly persons.

With these exceptions, the patients are hitherto kept very scrupulously to the diet at first directed. But after the eruption is completed, they are, if occasion requires, indulged in a little well boiled meat of the lightest kind, as chicken, veal, or mutton.

The abovementioned regimen, the cooling alterative purges, and the free use of cool air at the season of eruption, almost universally prevent either alarming symptoms or a large crop of pustules. Baron Dimsdale has seen a few with such a quantity of pustules, though distinct that he has neither advised nor allowed them to go out of the house. But the generality of his patients, where the eruptions are few, amuse themselves abroad, within proper limits, with the pustules upon them.

This practice, however, the Baron neither enjoins nor maintains to be necessary; but he has not been able to observe that any inconvenience has arisen from it. He also informs us, that, how strange soever it may appear, those who are most adventurous, seem to enjoy better spirits, and are more free from complaints, than others who are inclined to keep within doors.

Those who have the disease in the slightest manner first described, viz. without any appearance of eruption but on the inoculated part, are soon permitted to go about their usual affairs: and many instances have happened of very industrious poor men, who have immediately returned to their daily labour, with a caution not to intermix with those who have not had the distemper, for fear of spreading it; and with injunctions to take, two or three times, of the purge already directed, or as many doses of Glauber's salts. Those who have the disease in a greater degree, are confined somewhat longer; and, if there be the least disposition to costiveness, a very mild laxative is now and then exhibited; as the progress to maturation appears rather to be advanced than retarded by such means.

When the maturation is completed, and there is nothing far ther to fear from the distemper, Baron Dimsdale allows his patients gradually to change their course of diet, from the perfectly cooling kind, to one a little more generous; recommending strictly to all a return to their ordinary animal-diet, with much caution and restraint upon their appetites, both in respect of food and fermented liquors.

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He observes it is not often that we are under the necessity of making any application to the part where the insertion of the variolous matter was made. It most commonly heals up, and is covered with a scab, about the time when, in a natural way, all the small-pox would have been dried up. But in some cases the incisions continue to discharge a purulent matter a longer time. In these instances it is sufficient to cover the part with the white cerate, or any other mild emplastic substance, which may at once prevent the linen from adhering to the sore, and defend it from the air. As in these cases the part remains unhealed from some peculiar cause in the habit, it will be necessary to give gentle purgatives, and proper alteratives, as particular exigencies may require.

After describing the usual progress of the small-pox from inoculation, Baron Dimsdale remarks that there are frequent deviations from this course, which may embarrass an unexperienced practitioner, and create a real difficulty, as well as apprehensions of danger. He therefore proceeds to relate the means for removing those symptoms, and the doubts respecting the event.

The symptom he first notices, and which, though it very rarely happens, sometimes gives much trouble, is great sickness, accompanied with vomiting, in the eruptive state of the disease. For this complaint it is always necessary in the first place to clear the stomach; which may be effected, either by ordering the patient to drink plentifully of warm liquids to promote vomiting; or perhaps more properly, by giving to an adult one grain of tartarised antimony, mixed with ten grains of compound powder of crab's-claws; taking care to diminish the dose for very young and weak subjects.

This usually throws off some bilious matter by vomit, sometimes procures stools, or occasions a moderate sweat, and generally administers relief. If, however, no stools should follow from this medicine, and the sickness should remain, a gentle laxative almost certainly procures a respite, and the appearence of the eruption entirely removes the complaint.

Another deviation, of yet greater consequence, which sometimes happens towards the times of the eruption, and is often, though not always, accompanied with great sickness, is an erysipelatous efflorescence. If this shows itself on the skin partially, and here and there in patches, it is not very alarming, and soon wears off. But sometimes the whole surface of the body is covered with a rash intimately mixed with the variolous eruption, and so much resembling the most malignant kind of confluent small-pox as scarcely to be distinguished from it. In some such cases, accompanied with petechiæ and livid spots, Baron Dimsdale has been much alarmed; not being able by inspection only, though assisted by glasses, to determine whether what he saw was an inoffensive rash, or tokens of the greatest malignity. Very strict attention, however, has enabled

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enabled him to distinguish the difference clearly; and for assisting others in such a discrimination, he makes the following remarks.

The real and essential difference is to be gathered from the concomitant symptoms. In the erysipetalous or variolous rash, there is not so much fever, nor is the restlessness or pain of the head or loins so considerable neither is there that general prostration of strenth; all which are usual attendants on a confluent small-pox especially when accompanied with such putrid appearances. Besides. upon a careful examination, there may sometimes be discerned a few distinct pustules, larger than the rest, mixed with the rash, which are the real small-pox. In these cases the patients are ordered to refrain from cold water, or any thing cold and to keep within doors, but not in bed. If any sickness yet remains, a little white-wine whey, or other temperate cordial, is advised; and this method has been so generally successful, as to prevent any alarming complaint. After two or three days, the skin changes from a florid to a dusky colour, a few distinct pustules remain and advance properly to maturation without any farther trouble ensuing from this formidable appearance.

This rash has often been mistaken for the confluence it so much resembles; and has afforded occasion for some practitioners, either ignorantly or disingenously, to pretend, that, after a very copious eruption of the confluent pox, they can by a specific medicine, discharge the greater part of the pustules. leaving only as many distinct ones as may satisfy the patient that he has the disease.

Baron Dimsdale informs us, that rashes of the kind above described frequently happen during the preparation (whether owing to the regimen, or medicine, or both, he does not determine), and cause the operation to be postponed. But he has observed, that in such cases they are apt to return at the time of the eruption of the small pox.

In general, as has been already said, the symptoms which precede eruption commence at the end of the seventh or on the eighth day inclusive from the operation; but it often happens that they appear much sooner, and sometimes much later than this period. Baron Dimsdale has seen some cases in which the disease has come on so suddenly after infection, and with so little complaint or uneasiness, that the whole affair has been terminated, purges taken and the patient returned home perfectly well, in a week; before others, inoculated at the same time, from the same patient, and under the same circumstances, have begun to complain.

In this case, the inoculated part shows early certain marks of infection, sometimes on the very next day, or the day after, when the incision will often appear considerably inflamed and elevated, The patient about this time frequently makes some of the following complaints, viz. chillness, itchings and slight pricking pains in the part, and sometimes on the shoulder; giddiness, drowsiness, and a slight head-ach, sometimes attended with a feverish heat, but often without any. The account which patients themselves give of their feelings is, in some, as if they had drank too much, and in others, as if they had caught a cold. Those complaints seldom last 24 hours, often not so long, and with frequent intermissions; never, so far as our author remembers, rising to a degree that requires confinement. During the continuance of those complaints, the inflammation of the arm advances apace, and feels hard to the touch: but upon their wearing off, the inflamed appearances gradually diminish, and the part dries to a common small scab; the skin, that was before red, turns livid, and the disease entirely vanishes. In some instances, those symptoms attack much later; even on the seventh or eighth day, when an eruption might be expected in consequence of them, yet none appears; but the arm gets well very soon, and the disease is at an end.

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In this irregular sort of the disorder there have, however, been some examples where a few eruptions have appeared, and probably in consequence of the inoculation; yet the pustules have not looked like the true small-pox, neither have they maturated like them nor lasted longer than three days; about which time for the most part, they have dried away.

When this irregular kind of the disease first occurred in Baron Dimsdale's practice, he was in doubt whether the patients were quite secure from any future attacks of the distemper. In order to be satisfied of this point, he inoculated them a second time, causing them to associate with persons in every stage of the disease, and to try all other means of catching the infection. This method has been practised with the generality of such patients ever since, yet without a single instance of its producing any disorder. Baron Dimsdale, therefore, now makes no scruple of pronouncing them perfectly safe; and experience has enabled him to foretel, for the most part, in two or three days after the operation, whether the disease will pass in this slight manner.

Upon the second inoculation, however, the incised parts are commonly inflamed for a day or two, just in the same manner as has in numerous instances been observed, as well in those who, though certain of having had the small-pox in the natural way, have submitted to inoculation for the sake of experiment, as in others, who being doubtful whether they have had the disease or not, have been inoculated in order to be satisfied. But in all such cases, the parts soon became well; nor did any of those appearances which have been described as the constant attendants on inoculation, as pain in the head, giddiness, marks of infection, in the arm, &c. ensue. Neither can those appearances ever be produced upon a person who has had the small-pox before, either in the natural way or by inoculation.

Another irregularity deserving notice is, that some times upon the abatement of the fever and other symptoms, after the appearance of several pustules, and when the eruptive stage of the disease seems completed, it nevertheless happens that fresh eruptions come out, and continue doing so daily, for four, five, or even six days successively; preceded sometimes by a slight pain in the head, though more frequently they appear without any new disturbence. Those are generally few, of short duration, and seldom come to maturity. Baron Dimsdale, however, has seen four cases in which, after a cessation of complaints, and an appearance of few pustules, the eruptive stage of the disease was thought to be over, yet in two or three days

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a freſh fit of fever has attacked the patients, and after a ſhort illneſs a quantity of new puſtules has broke out far exceeding the firſt number, and thoſe remained and matured completely,

Some of the Baron's own patients, and, as he has been credibly informed, thoſe of other inoculators, have had conſiderable eruptions of this kind after they returned home; which have probably given occaſion for the reports of ſeveral having had the diſeaſe in the natural way after inoculation. But in confirmation that thoſe reports are ill-grounded, he obſerves, that in all the caſes of this ſort which have occurred in his own practice, or as far as he can learn, in that of others, the ſecond or latter crop of puſtules has always happened within the time uſually allowed for the progreſs of the ſmall-pox from inoculation; before the inflammation on the arm has ceaſed, and ſooner than we can ſuppoſe them to have been produced by infection received in the natural way. When this has happened, it has been to perſons in whom, after a ſlight eruption and abatement of ſymptoms, the diſeaſe has prematurely been judged to be quite over, and they have therefore been permitted to return to their families.

An appearance, more alarming and more dangerous than any of thoſe which have already been taken notice of, is the occurrence of epileptic fits. For although it has been remarked, that theſe are often the forerunners of a mild diſeaſe, both in caſes of accidental and likewiſe of intentional contagion; yet it is undeniable, that in not a few inſtances they have of themſelves proved fatal. Wherever, therefore, an epileptic fit occurs, it naturally claims the attention of the practitioner. The occurence of future fits is beſt prevented by the employment of tincture of opium, taking off the tendency to inordinate action by giving at leaſt a temporary diminution of irritability; and on the ſame principle, when during a fit the patient is able to ſwallow, nothing is more effectual either in ſhortening the fit or diminiſhing its ſeverity, then a doſe of laudanum accommodated to the age and condition of the patient. Conſiderable benefit may be deprived from any volatile alkaline ſpirit, ſuch as ſpirit of hartſhorn, the favourite remedy of Dr Sydenham in ſuch caſes. But the beſt effects may be obtained from the uſe of the tepid bath, which is not only of ſervice in ſuch caſes from its action as an antiſpaſmodic, but which alſo, by producing relaxation of the ſkin facilitates and promotes the eruption. And even allowing that, as ſome imagine, the number of puſtules ſhould be increaſed by heat applied in this manner; yet much leſs is to be dreaded from thence than from the continuance of the fits.

Baron Dimſdale next conſiders the conſequences that ariſe from this very cool and repelling method and how far the patients future ſtate of health may be affected by a practice ſo oppoſite to what was formerly employed.

It has been the general opinion, that in moſt or all eruptive complaints, eſpecially the ſmall-pox, the rational method of cure was to forward, by every gentle means, the efforts of nature in producing an eruption and on the contrary, that there was danger in checking it, either by cold air, cold drink, or any conſiderable evacuations. For this purpoſe the uſe of warm diluents, and the lying in bed, eſpecially if the fever and ſymptoms run high, or at leaſt confining to the houſe, have been generally approved and recommended. Experience, however, has now ſufficiently confirmed the advantage of a different kind of treatment.

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While the old methods prevailed of conducting inoculation, the patients, particularly children, after paſſing through the diſeaſe in a very favourable manner, were frequently liable to abſceſſes in the axilla and other parts, tedious ophthalmies, and troubleſome ulcerations in the place of inſertion; which though they could not be foreſeen nor prevented, yet often gave more pain and vexation to the patients, and trouble to the operator, than the diſeaſe itſelf had done. But on inquiry into the ſtate of thoſe who have been treated in the cool way, or according to the new method, Baron Dimſdale affirms, that in more than 1500 there has been only one who has had ſo much as a boil in the axilla; and this was a child who had in the ſame arm an iſſue, which was at that time dried up. He has ſeen only two very ſmall ſuperficial boils in others near the place of inſertion: and thoſe ſeemed to be occaſioned rather by an irritation from the diſcharge than by any other cauſe, and were all ſoon healed with very little trouble.

In a few inſtances alſo, there has been a ſlough in the inciſed part, which has cauſed a ſore of ſhort duration; but not one inſtance of an ulcer of any continuance. Such like breakings out too, and ſcabs as frequently ſucceed the mild natural ſmall-pox, ſometimes though rarely happen to thoſe inoculated in the new way; and, as they are of little conſequence, are generally cured by the ſame method, the uſe of a few gentle purges.

In regard to ophthalmies from this kind of practice, Baron Dimſdale has never known an inſtance of one truly deſerving that name. The coats of the eye have been a little inflamed in a very few, but they ſoon became clear, without any means uſed for that purpoſe. He knows but two caſes where he thought the inflammation great enough to require bleeding; and not one where a bliſter was neceſſary. Thoſe complaints, therefore, which were formerly ſo frequent and troubleſome, ſeem to be much reduced by the new method, the great utility of which is now univerſally acknowledged.

When the benefits of inoculation have now been demonſtrated to be ſo great, it is truly ſurpriſing that the practice has not yet become general. Even its wonderful ſucceſs, however, particularly when contraſted with the natural ſmall-pox, has not been ſufficient to remove every prejudice againſt it; and in many parts of Britain, the lower claſs are deterred from it by ſcruples even of a religious nature, by which means the ſtate annually ſuſtains a very conſiderable loſs. It is, however, but juſt to obſerve, that in many parts, both the medical practitioners and the clergy have done all in their power to remove every difficulty. At Edinburgh, the colleges of phyſicians and ſurgeons annually make an offer of their aſſiſtance and advice *gratis* to all the poor who ſubmit to this operation during certain months; and a moſt reſpectable clergyman has been at the expence of publiſhing a plain and ſenſible diſcourſe, not only calculated to remove every religious doubt or ſcruple which can be entertained on

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this head, but also clearly demonstrating to parents that they have themselves to blame for the death of their children if they neglect to employ the means with which Providence has furnished them for preserving the lives of their offspring.

226 GENUS XXIX. VARICELLA.

CHICKEN-POX.

Varicella, *Vog.* 42.
Variola lymphatica, *Sauv*, sp. 1.
Anglis, *The* CHICKEN-POX, Edin. Med. Essays, vol. ii. art. 2. near the end. *Heberden*, Med. Transac. art. 17.

This is in general a very slight disease; and is attended with so little danger, that it woul not merit any notice, if it were not apt to be confounded with the small-pox, and thus give occasion to an opinion that a person might have the small-pox, twice in his life; or they are apt to deceive into a false security those who have never had the small-pox, and make them believe that they are safe when in reality they are not. This eruption breaks out in many, according to Dr Heberden, without any illness or previous sign; in others it is preceded by a little degree of chillness, lassitude, cough, broken sleep, wandering pains, loss of appetite, and feverish state for three days.

In some patients the chicken-pox make their first appearance on the back; but this perhaps is not constant. Most of them are of the common size of the small-pox, but some are less. Dr Heberden never saw them confluent, nor very numerous. The greatest number was about 12 in the face, and 200 over the rest of the body.

On the first day of the eruption they are reddish. On the second day there is at the top of most of them a very small bladder, about the size of a millet-seed. This is sometimes full of a watery and colourless, sometimes of a yellowish liquor contained between the cuticle and skin. On the second, or at the farthest, on the third day from the beginning of the eruption, as many of these pocks as are not broken seem arrived at their full maturity; and those which are fullest of that yellow liquor very much resemble what the genuine small-pox are on the fifth or sixth day, especially where there happens to be a larger space than ordinary occupied by the extravasated serum. It happens to most of them, either on the first day that this little bladder arises, or on the day after, that its tender cuticle is burst by the accidental rubbing of the clothes, or by the patien's hands to allay the itching which attends this eruption. A thin scab is then formed at the top of the pock, and the swelling of the other part abates, without its ever being turned into pus, as it is in the small-pox. Some few escape being burst; and the little drop of liquor contained in the vesicle at the top of them, grows yellow and thick, and dries into a scab. On the fifth day of the eruption they are almost all dried and covered with a slight crust. The inflammation of these pocks is very small, and the contents of them do not seem to be owing to suppuration, as in the small-pox, but rather to what is extravasated under the cuticle by the serous vessels of the skin, as in a common blister. No wonder, therefore, that this liquor appears so soon as on the second day; and that, upon the cuticle being broken, it is presently succeeded by a slight scab: hence too as the true skin is so little affected, no mark or scar is likely to be left, unless in one or two pocks, where, either by being accidentally much fretted, or by some extraordinary sharpness of the contents, a little ulcer is formed in the skin.

Varicella.

The patients scarce suffer any thing throughout the whole progress of this illness, except some languidness of strength and spirits and appetite; all which is probably owing to the confining of themselves to their chamber.

Two children were taken ill of the chicken-pox, whose mother chose to be with them, though she had never had this illness. Upon the eighth or ninth day after the pocks were at their height in the children, the mother fell ill of this distemper then beginning to show itself. In this instance the infection lay in the body much about the same time that it is known to do in the small-pox

Remedies are not likely to be much wanted in a disease attended with hardly any inconvenience, and which in so short a time is certainly cured of itself.

The principal marks by which the chicken-pox may be distinguished from the small pox are,

1. The appearance, on the second or third day from the eruption, of that vesicle full of serum upon the top of the pock.

2. The crust, which covers the pocks on the fifth day; at which time those of the small-pox are not at the height of their suppuration.

Foreign medical writers hardly ever mention the name of this distemper; and the writers of Great Britain scarce mention any thing more of it than its name. Morton speaks of it as if he supposed it to be a very mild genuine small-pox. But these two distempears are surely totally different from one another, not only on account of their different appearances abovementioned, but because those who have had the small-pox are capable of being infected with the chicken-pox; but those who have once had the chicken-pox are not capable of having it again, though to such as have never had this distemper, it seems as infectious as the small-pox. Dr Heberden wetted a thread in the most concocted pus-like liquor of the chicken-pox which he could find; and after making a slight incision, it was confined upon the arm of one who had formerly had it; the little wound healed up immediately, and showed no signs of any infection.

From the great similitude between the two distempers, it is probable, that instead of the small-pox, some persons have been inoculated from the chicken-pox; and that the distemper which has succeeded, has been mistaken for the small-pox by hasty or unexperienced observers.

There is sometimes seen an eruption, concerning which Dr Heberden is in doubt whether is to be one of the many unnoticed cutaneous diseases, or only a more malignant sort of chicken-pox.

This disorder is preceded for three or four days by all the symptoms which forerun the chicken-pox; but in a much higher degree. On the fourth or fifth day the erruption apears, with very little abatement of the fever: the pains likewise of the limbs and back still continue, to which are joined pains of the gums. The pocks

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pocks are redder than the chicken-pox, and spread wider; and hardly rise so high, at least not in proportion to their size. Instead of one little head or vesicle of a serous matter, these have from four to ten or twelve. They go off just like the chicken-pox, and are distinguishable from the the small-pox by the same marks; besides which, the continuance of the pains and fever after the eruption, and the degree of both these, though there be not above 20 pocks, are circumstances never happening in the small-pox.

227 GENUS XXX. RUBEOLA. MEASLES.

Rubeola, *Sauv.* gen. 94. *Lin.* 4. *Sag.* 293.
Febris morbillosa, *Vog.* 36. *Hoffm.* II. 62.
Morbilli, *Junck.* 76.

Sp. I. The *Regular* MEASLES.

Rubeola vulgaris, *Sauv.* sp. 1.
Morbilli regulares, *Sydenh.* sect. iv. cap. v.

Var. 1. The *Anomalous* MEASLES.

Rubeola anomala, *Sauv.* sp. 2.
Morbilli anomali, *Sydenh.* sect. v. cap. 3.

Var. 2. The MEASLES attended wih *Quinsy*.

Var. 3. The MEASLES with *Putrid Diathesis* of the Blood.

228 Sp. II. The VARIOLODES.

In Scotland commonly called the *Nirles*.

Rubeola variolodes, *Sauv.* sp. 3.

Description. This disease begins with a cold stage, which is soon followed by a hot, with the ordinary symptoms of thirst, anorexia, anxiety, sickness, and vomiting; and these are more or less considerable in different cases. Sometimes from the beginning the fever is sharp and violent: often, for the first two days, it is obscure and inconsiderable; but always becomes violent before the eruption, which commonly happens on the fourth day. This eruptive fever, from the beginning of it, is always attended with hoarseness, a frequent hoarse dry cough, and often with some difficulty of breathing. At the same time, the eye-lids are somewhat swelled; the eyes are a little inflamed, and pour out tears; and with this there is a coryza, and frequent sneezing. For the most part, a constant drowsiness attends the beginning of the disease. The eruption, as we have said, commonly appears upon the fourth day, first on the face, and successively on the lower parts of the body. It appears first in small red points; but, soon after, a number of these appear in clusters, which do not arise in visible pimples, but, by the touch, are found to be a little prominent. This is the case on the face; but, in other parts of the body, the prominency, or roughness, is hardly to be perceived. On the face, the eruption retains its redness, or has it increased for two days; but on the third, the vivid redness is changed to a brownish red; and in a day or two more the eruption entirely disappears, while a mealy desquamation takes place. During the whole time of the eruption, the face is somewhat turgid, but seldom considerably swelled. Sometimes, after the eruption has appeared, the fever ceases entirely: but this is seldom the case; and more commonly the fever continues or is increased after the eruption, and does not cease till after the desquamation. Even then the fever does not always cease, but continues with various duration and effect. Though the fever happen to cease upon the eruption's taking place, it is common for the cough to continue till after the desquamation, and sometimes much longer. In all cases, while the fever continues, the cough also continues, generally with an increase of the difficulty of breathing; and both of these symptoms sometimes arise to a degree which denote a pneumonic affection. This may happen at any period of the disease; but very often it does not come on till after the desquamation of the eruption.

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After the same period, also, a diarrhœa frequently comes on, and continues for some time.

It is common for measles, even when they have not been of a violent kind, to be followed by inflammatory affections, particularly ophthalmia and phthisis. If blood be drawn from a vein in the measles, with circumstances necessary to favour the separation of the gluten, this always appears separated, and lying on the surface of the crassamentum, as in inflammatory diseases. For the most part, the measles, even when violent, are without any putrid tendency; but in some cases, such a tendency appears both in the course of the disease, and especially after the ordinary course of it is finished.

Causes. The measles are occasioned by a peculiar kind of contagion, the nature of which is not understood; and which, like that of the small-pox, affects a person only once in his life.

Prognosis. From the description of this distemper already given, it appears that the measles are attended with a catarrhal affection, and with an inflammatory diathesis to a considerable degree; and therefore the danger of them is to be apprehended chiefly from the coming on of a pneumonic inflammation.

Cure. In measles, as well as in small-pox, the disease from its nature must necessarily run a determined course; and therefore the sole aim of a practitioner is to conduct this course in the easiest manner, by preventing and obviating urgent symptoms.

From the consideration mentioned in the prognosis, it will be obvious, that the remedies especially necessary are those which may obviate and diminish the inflammatory diathesis; and therefore, in a particular manner, blood-letting. This remedy may be employed at any time in the course of the disease, or after the ordinary course of it is finished. It is to be employed more or less, according to the urgency of the symptoms of fever, cough, and dyspnœa; and generally may be employed very freely. But as the symptoms of a pneumonic inflammation seldom come on during the eruptive fever, and as this is sometimes violent immediately before the eruption, though a sufficiently mild disease be to follow; bleeding is seldom very necessary during the eruptive fever, and may often be reserved for the times of greater danger which are perhaps to follow.

In all cases of measles, where there are no marks of putrescency, and where there is no reason, from the known nature of the epidemic, to apprehend putrescency, bleeding is the remedy most to be depended upon:

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upon: but assistance may also be drawn from cooling purgatives; and particularly from blistering on the sides or between the shoulders. The dry cough may be alleviated by the large use of demulcent pectorals, mucilaginous, oily, or sweet. It may, however, be observed with respect to these demulcents, that they are not so powerful in involving and correcting the acrimony of the mass of blood as has been imagined; and that their chief operation is by besmearing the fauces, and thereby defending them from the irritation of acrids, either arising from the lungs or distilling from the head. For moderating and quieting the cough in this disease, opiates certainly prove the most effectual means, whenever they can be safely employed. In the measles, in which an inflammatory state prevails in a considerable degree, opiates have indeed by some been supposed to be inadmissible: but experience abundantly demonstrates, that the objection made to their use is merely hypothetical; and even in cases where, from a high degree of pyrexia and of dyspnœa, there is reason to fear the presence, or at least the danger, of pneumonic inflammation, opiates are highly useful; after bleeding, to obviate or abate the inflammatory state, has been duly employed: in such cases, while the cough and watchfulness are the urgent symptoms, opiates may be safely exhibited, and with great advantage. In all the exanthemata, there is an acrimony diffused over the system, which gives a considerable irritation; and, for obviating the effects of this, opiates are useful, and always proper, when no particular contra-indication prevails.

When the desquamation of the measles is finished, though then there should be no disorder remaining, physicans have thought it necessary to purge the patient several times, with a view to draw off what have been called the *dregs of this disease;* that is, a portion of the morbific matter which is supposed to remain long in the body. Dr Cullen does not reject this supposition; but at the same time cannot believe that the remains of the morbific matter diffused over the whole mass of blood, can be wholly drawn off by purging; and therefore thinks, that, to avoid the consequence of the measles, it is not the drawing off the morbific matter which we need to study, so much as to obviate and remove the inflammatory state of the system which had been induced by the disease. With this last view indeed, purging may still be a proper remedy; but bleeding, in proportion to the symptoms of inflammatory disposition is still more so.

From our late experience of the use of cold air in the eruptive fever of the small-pox, some physicians have been of opinion that the practice may be transferred to the measles; but this point has not yet been determined by sufficiently extensive experience. We are certain, that external heat may be very hurtful in the measles, as in most other inflammatory diseases; and therefore, that the body ought to be kept in a moderate temperature during the whole course of the disease: but how far, at any period of the disease, cold air may be applied with safety, is still uncertain. Analogy, though so often the resource of physicians, is frequently fallacious; and further, though the analogy with the small-pox might lead to the application of cold air during the eruptive fever of the measles, the anaolgy with catarrh seems to be against the practice. When the eruption is upon the skin, there are many instances of cold air making it disappear, and thereby producing much disorder in the system; and there are also frequent instances of this disorder's being removed by restoring the heat of the body, and thereby again bringing out the eruption.

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Upwards of 20 years ago, inoculation for the measles was proposed, and practised in several instances with success, by Dr Home of Edinburgh. His method of communicating the infection was, by applying to an incision in each arm cotton moistened with the blood of a patient labouring under the measles; but with others who have made similar trials, the attempt has not yet succeeded. And attempts have been made to inoculate this disease by means of the fluid discharged under the form of tears, the squamæ falling from the surface, and the like; but there is reason to believe, that where it was imagined the infection had thus been communicated, the contagion was only carried about the person inoculating, and communicated in the ordinary way.

From inoculation of the measles, it is imagined that several advantages may be obtained, and among others, it is thought the soreness of the eyes may be mitigated, the cough abated, and the fever rendered less severe. But the practice was never much in fashion, and now is scarce ever heard of.

Genus XXXI. MILIARIA. 229

The Miliary Fever.

Miliaria, *Lin.* 7.
Miliaris, *Sauv.* gen. 95. *Sag.* gen. 295.
Febris miliaris, *Vog.* 37.
Febris purpurata rubra et alba miliaris, *Hoffm.* II. 68.
Febris purpurea seu miliaris, *Junk.* 75.
Germanis der Friesel. *God. Welsch*, Hist. Med. de novo puerperarum morbo, qui der *Friesel* dicitur, Lipf. 1655.
Hamilton, de febr. miliar. 1710. *Fantonus*, de febr. mil. 1747. *Allioni* de miliar. 1758. *Fordyce*, de febr. mil. 1748. *Fischer*, de febr. mil. 1767. *De Haen*, de divis. febr. 1760, et in Ration. med. passim. *Mat. Collin* ad Baldinger de miliar. 1764.
Miliaris benigna, *Sauv.* sp. 1.
Miliaris maligna, *Sauv.* sp. 2.
Miliaris recidivans, *Sauv.* sp. 3.
Miliaris Germanica, *Sauv.* sp. 5.
Miliaris Boia, *Sauv.* sp. *a.*
Miliaris Britannica, *Sauv.* sp. *i.*
Miliaris nova febris, *Sydenh.* Sched. monit. *Sauv.* sp. *d.*
Miliaris sudatoria, *Sauv.* sp. *e.*
Miliaris nautica, *Sauv.* sp. *g.*
Miliaris purpurata, *Sauv.* sp. *h.*
Miliaris lactea, *Sauv.* sp. *c.*
Miliaris puerperarum, *Sauv.* sp. *k.*
Miliaris scorbutica, *Sauv.* sp. *l.*
Miliaris critica, *Sauv.* sp. *b.*

History and Description. This disease is said to have been unknown to the ancients, and that it appeared for the first time in Saxony about the middle of the last century. It is said to have since spread from thence into all the other countries of Europe; and, since the period mentioned, to have appeared in many

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many countries in which it had never appeared before.

From the time of its having been first taken notice of, it has been described and treated of by many different writers; and by all of them, till very lately, has been considered as a peculiar idiopathic disease. It is said to have been constantly attended with peculiar symptoms. It comes on with a cold stage, which is often considerable. The hot stage, which follows, is attended with great anxiety, and frequent sighing. The heat of the body becomes great, and soon produces profuse sweating, preceded, however, with a sense of pricking, as of pin points in the skin; and the sweat is of a peculiar rank and disagreeable odour, The eruption appears sooner or later in different persons, but at no determined period of the disease. It seldom or never appears upon the face; but appears first upon the neck and breast, and from thence often spreads over the whole body.

The eruption named *miliary* is said to be of two kinds; the one named the *red*, the other the *white miliary*. The former, which in English is strictly named a *rush*, is commonly allowed to be a symptomatic affection; and as the latter it is the only one that has any pretensions to be considered as an idiopathic disease, it is this only that we shall more particularly describe and treat of under this genus.

What is then called the *white miliary eruption*, appears at first like the red, in very small red pimples for the most part distinct, but sometimes clustered together. Their little prominence is better distinguished by the finger than by the eye. Soon after the appearance of this eruption, and, at least, on the second day, a small vesicle appears upon the top of the pimples. At first the vesicle is whey-coloured; but soon becomes white, and stands out like a little globule on the top of the pimple. In two or three days those gloubules break, or are rubbed off; and are succeeded by small crusts, which soon after fall off in small scales. While one set of pimples take this course, another set arise to run the same; so that the disease often continues upon the skin for many days together. Sometimes when one crop of this eruption has disappeared, another, after some interval, is produced. And it has been further observed, that in some persons there is such a disposition to this disease, that they have been affected with it several times in the course of their lives.

This disease is said to affect both sexes, and persons of all ages and constitutions; but it has been observed at all times to affect especially, and most frequently, lying-in women.

It is often accompanied with violent symptoms and has frequently proved fatal. The symptoms, however attending it are very various; and they are, upon occasions, every one attending febrile diseases; but no symptom, or concourse of symptoms, are steadily the same in different persons, so as to give any specific character to the disease. When the disease is violent, the most common symptoms are phrenetic comatose, and convulsive affections which are also symptoms of all fevers treated by a very warm regimen.

While there is such a variety of symptoms appearing in this disease, it is not to be expected that any one particular method of cure can be proposed; and, accordingly, we find in diffrent writers different methods and remedies prescribed; frequent disputes about the most proper; and those received and practised by some, opposed and deserted by others.

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It appears, however, to Dr Cullen, very improbable, that this was really a new disease, when it was first considered as such. There are very clear traces of it in authors who wrote long before that period; and though there were not, we know that ancient descriptions were often inaccurate and imperfect, particularly with respect to cutaneous affections; and we know also that those affections which commonly appeared as symptomatic only, were often neglected, or confounded together under a general appellation.

The antecedent symptoms of anxiety, sighing, and pricking of the skin, which have been spoken of as peculiar to this disease, are, however, common to many others; and perhaps to all those in which sweatings are forced out by a warm regimen. Of the symptoms said to be concomitant of this eruption, there are none which can be affirmed to be constant and peculiar but that of sweating. This, indeed, always precedes and accompanies the eruption; and, while the miliary eruption attends many different diseases, it never, however, appears in any of these but after sweating; and in persons labouring under the same diseases it does not appear, if in such persons sweating be avoided. It is therefore probable, that the eruption is the effect of sweating: and that it is the effect of a matter not before prevailing in the mass of blood, but generated under particular circumstances in the skin itself. That it depends upon particular circumstances of the skin, is also probable from its being observed that the eruption seldom or never appears upon the face, although it affects the whole of the body besides; and that it comes upon those places especially which are more closely covered; and that it can be brought out upon particular places by external applications.

It is to be observed, that this eruptive disease differs from the other exanthemata in many circumstances, especially the following; that it is not contagious, and therefore never epidemic; that the eruption appears at no determined period of the disease; that the eruption has no determined duration; that successive eruptions frequently appear in the course of the same fever, and that such eruptions frequently recur in the course of the same person's life. All this renders it very probable, that, in the miliary fever, the morbific matter is not a subsisting contagion communicated to the blood, and thence, in consequence of fever and assimilation, thrown out upon the surface of the body, but a matter occasionally produced in the skin itself by sweating.

This conclusion is further rendered probable from hence, that, while the miliary eruption has no symptoms or concourse of symptoms peculiar to itself, it, upon occasions, accompanies almost every febrile disease, whether inflammatory or putrid, if these happen to be attended with sweating; and from thence it may be presumed, that the miliary eruption is a symptomatic affection only, produced in the manner we have said.

But as this symptomatic affection does not always accompany every instance of sweating, it may be proper to inquire, what are the circumstances which especially

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cially determine this eruption to appear? And to this Dr Cullen gives no full and proper answer. He cannot say that there is any one circumstance which in all cases gives occasion to this eruption; nor can he say what different causes, in different cases, may give occasion to it. There is only one observation that can be made to the purpose of this inquiry; and it is, that these persons sweating, under febrile diseases are especially liable to the miliary eruption, who have been previously weakened by large evacuations, particularly of blood. This will explain why it happens to lying-in women more frequently than to any other persons; and to confirm this explanation, he has observed, that the eruption has happened to other women though not in child-bed, but who had been much subjected to a frequent and copious menstruation, and to an almost constant *fluor albus*. He has also observed it to have happened to men in fevers, after wounds from which they had suffered a great loss of blood.

Further, that this eruption is produced by a certain state of debility, is, he thinks, probable, from its so often attending fevers of the putrid kind, which are always atttended with great debility. It is true, that it also sometimes attends inflammatory diseases, when it cannot be accounted for in the same manner; but he believes it may be observed, that it especially attends those inflammatory diseases in which the sweats have been long protracted, or frequently repeated, and which have thereby produced a debility, and perhaps a debilitating putrid diathesis.

That, however, the miliary eruption is not necessarily or even generally connected with a certain state of debility, is abundantly evident from its being entirely wanting in by much the greater number of instances of typhoid fever, and in a variety of other diseases where every possible degree of debility occurs: And that it is not connected with any certain state of debility, still farther appears, both from the condition of those affected with it in different instances, which in point of strength is very various; and likewise from the continuance of fresh eruptions with the same individual, although during that time in very different states with respect to debility. It appears, therefore, much more probable, that it depends on some peculiar state of the surface, induced by the concurring influence of certain predisposing and occasional causes.

It appears so clearly that this eruption is always a symptomatic and factitious affection that Dr Cullen is persuaded it may be, in most cases, prevented merely by avoiding sweats. Spontaneous sweatings, in the beginning of diseases, are very rarely critical; and all sweatings not evidenly critical, should be prevented, or at least moderated; and the promoting them, by increasing external heat, is commonly very pernicious. Even critical sweats should hardly be encouraged by such means. If, therefore, spontaneous sweats arise, they are to be checked by the coolness of the chamber; by the lightness and looseness of the bed-cloaths; by the persons laying out their arms and hands; and by their taking cold drink: and in this way Dr Cullen thinks he has frequently prevented miliary eruptions, which were otherwise likely to have appeared, particularly in puerperal women.

But it may happen, when these precautions have been neglected, or from other circumstances, that a miliary eruption does actually appear; and the question will then be put, how the case is to be treated? This in a question of consequence; as there is reason to believe that the matter here generated is often of a virulent kind; it is often the offspring of putrescency; and, when treated by increasing the external heat of the body, it seems to acquire a virulence which produces those symptoms mentioned above, and proves certainly fatal.

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It has been an unhappy opinon with most physicians, that eruptive diseases were ready to be hurt by cold; and that it was therefore necessary to cover up the body very closely, and thereby increase the external heat. We now know that this is a mistaken opinion; that increasing the external heat of the body is very generally mischievous: and that several eruptions not only admit, but require the application of cold air. Dr Cullen is persuaded, therefore, that the practice which formerly prevailed in the case of miliary eruptions, of covering up the body closely, and both by external means and internal remedies encouraging the sweatings which accompany this eruption, was highly pernicious, and commonly fatal. He is therefore of opinion, that even when a miliary eruption has appeared, in all cases in which the sweating is not manifestly critical, we should employ all the means of stopping the sweating that are mentioned above; and he has sometimes had occasion to observe, that even the admission of cool air was safe and useful.

This is, in general the treatment of miliary eruptions: but at the same time, the remedies suited to the primary disease are to be employed; and therefore, when the eruption happens to accompany inflammatory affections, and the fullness and hardness of the pulse or other symptoms show an inflammatory state present, the case is to be treated by blood-letting, purging and other antiphlogistic remedies.

Upon the other hand, when the miliary eruption attends diseases, in which debility and putrescency prevail, it will be proper to avoid all evacuations, and to employ tonic and antiseptic remedies, particularly the Peruvian bark, cold drink, and cold air.

The most distressing circumstance attending this affection, is the almost unsupportable sickness at stomach which frequently occurs, and which is often observed to precede fresh eruptions taking place during the course of the disease. With the view of counteracting and alleviating this symptom, recourse is had to wine and other cordial medicines. But with many patients nothing is found to have so much influence as the use of camphor, particularly when introduced gradually in small doses, under the form of the *mistura camphorata*, of the London Pharmacopeia, or the *emulsio camphorata* of that of Edinburgh.

We shall conclude this subject with observing, that the venerable octogenarian practitioner, de Fischer, when treating of this subject, in laying down the indications of cure, has given this as one of them: "Excretionis periphericæ non primariam habere rationem."

Genus XXXII. SCARLATINA. 230
Scarlet Fever.

Scarlatina, *Sauv.* gen. 98. *Vog.* 39. *Sag.* 294. *Junck.* 75.

Sp. I.

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Sp. I. The Mild Scarlet Fever.

Scarlatina febris, *Sauv.* sp. 1. *Sydenham*, sect. vi. cap. 2.

Sp. II. The Scarlet Fever with *Ulcerated Sore Throat.*

Scarlatina anginosa. *Withering* on the Scarlet Fever.

The mild scarlet fever is described by Sydenham, who tells us that he can scarce account it a disease; and indeed nothing more seems to be necessary in the treatment of it than an antiphlogistic regimen, avoiding the application of cold air and cold drink. The disease however sometimes rages epidemically, and is attended with very alarming symptoms, bearing no small resemblance to the cynanche maligna, in which case it it is called *scarlatina anginosa*.—The best description of this distemper has been published by Dr Withering in the year 1778. This disease made its appearance, we are told, at Birmingham and the neighbouring villages, about the middle of May 1778. It continued in all its force and frequency to the end of October; varying, however, in some of its symptoms, as the air grew colder. In the beginning of November it was rarely met with; but towards the middle of that month, when the air became warmer, it increased again, and in some measure resumed those appearances it possessed in the summer-months, but which it had lost during the cold winds in October.

It affected children more than adults; but seldom occurred in the former under two years of age, or in the latter if they had passed their fiftieth year.

Description. With various general symptoms of fever, the patient at first complains of a dejection of spirits, a slight soreness or rather stiffness in the neck, with a sense of straitness in the muscles of the neck and shoulders, as if they were bound with cords. The second day of the fever this soreness of the throat increases, and the patients find a difficulty in swallowing; but the difficulty seems less occasioned by the pain excited in the attempt, or by the straitness of the passage, than by an inability to throw the necessary muscles in action. The skin feels hot and dry, but not hard; and the patients experience frequent, small, pungent pains, as if touched with the point of a needle. The breath is hot and burning to the lips, and thirst makes them wish to drink; but the tendency to sickness, and the exertions necessary in deglutition, are so unpleasant, that they seldom care to drink much at a time. They have much uneasiness also from want of rest during the night. In the morning of the third day, the face, neck, and breast, appear redder than usual: in a few hours this redness becomes universal; and increases to such a degree of intensity, that the face, body, and limbs, resemble a boiled lobster in colour, and are evidently swollen. Upon pressure the redness vanishes, but soon returns again. The skin is smooth to the touch, nor is there the least appearance of pimples or pustules. The eyes and nostrils partake more or less of the general redness; and in proportion to the intensity of this colour in the eyes, the tendency to delirium prevails.

Things continue in nearly this state for two or three days longer, when the intense scarlet gradually abates, a brown colour succeeds, and the skin becoming rough, peels off in small scales. The tumefaction subsides at the same time, and the patients gradually recover their strength and appetite. Scarlatina.

During the whole course of the disease, the pulse is quick, small, and uncommonly feeble; the urine small in quantity; the sub-maxillary glands somewhat enlarged and painful to the touch. The velum pendulum palati, the uvula, the tonsils, and gullet, as far as the eye can reach, partake of the general redness and tumefaction; but although collections of thick mucus, greatly resembling the specks or sloughs in the putrid sore throat, sometimes occur, yet those are easily washed off, and real ulcerations of those parts were never observed.

These are the most usual appearances of this disorder; but it too frequently assumes a much more fatal form. In some children the delirium commences in a few hours after the first attack; the skin is intensely hot; the scarlet colour appears on the first or second day, and they die very early on the third. Others again, who survive this rapid termination, instead of recovering, as is usual, about the time the skin begins to get its natural colour, fall into a kind of lingering, and die at last in the course of six or eight weeks.

In adults, circular livid spots were frequently observed about the breast, knees, and elbows; also large blotches of red, and others of white intermixed, and often changing places.

In the month of October, when the air becomes colder, the scarlet colour of the skin was both less frequent and less permanent. Many patients had no appearance of it at all; whilst others, especially adults, had a few minute red pimples, crowned with white pellucid heads. The inside of the throat was considerably tumefied; its colour a dull red, sometimes tending to a livid. The pulse beat in general 130 or 140 strokes in a minute; was small, but hard, and sometimes sufficiently so to justify the opening of a vein; and the blood thus taken away, in every instance when cool, appeared sizy, and the whole crassamentum firm.

Happy would it be, Dr Withering observes, if the baneful influence of this disorder terminated with the febrile symptoms. But in ten or fifteen days from the cessation of the fever, and when a complete recovery might be expected, another train of symptoms occur, which at last frequently terminate fatally. The patients, after a few days amendment, feel a something that prevents their farther approach to health; an unaccountable langour and debility prevails, a stiffness in the limbs, an accelerated pulse, disturbed sleep, disrelish to food, and a scarcity of urine. These symptoms, we are told, are soon succeeded by swellings of a real dropsical nature, forming sometimes an anasarca, and on other occasions an ascites; and not unfrequently scarlatina has proved fatal, from supervening hydrothorax in consequence of the effusion of water into the chest. It is unnecessary to remark, that when this happens, a fatal termination is more sudden than from any other modification of dropsy.

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Dr Withering, after examining the accounts given of this diſeaſe by different authors, proceeds to the diagnoſis. It may be diſtinguiſhed, he obſerves, from the petechial fever, by the eruption in the latter appearing ſeldom before the fourth day, by the regularity and diſtinctneſs of the ſpots, and by its principally occupying the neck, the back, and the loins. On the other hand, in the ſcarlet fever, the eruption generally appears about the third day; conſiſts either of broad blotches, or elſe one continued redneſs, which ſpreads over the face and the whole body.

In the fever called *purpura*, the puſtules are prominent, keep their colour under preſſure, and never appear early in the diſeaſe; whereas in the ſcarlet fever, the eruption appears more early, is not prominent, but perfectly ſmooth to the touch, and becomes quite white under preſſure.

Although the *purple fever* and *ſcarlatina* may be connected by ſome general cauſe, yet our author takes occaſion to obſerve, that they cannot be mere modifications of the ſame eruption: for examples occur, he ſays, of the ſame perſon being firſt ſeized with one of theſe diſorders, and afterwards with the other; but he never met with an inſtance of the ſame perſon having the ſcarlet fever twice; and he believes it to be as great an improbability as a repetition of the ſmall-pox.

This diſorder is particularly diſtinguiſhed from the *meaſles*, we are told, by the want of that cough, watery eye, and running at the noſe, which are known to be the predominant ſymptoms in the early ſtate of the meaſles, but are never known to exiſt in the ſcarlatina.

From the *eryſipelas* this diſeaſe is diſtinguiſhable, by the limited ſeat of the former, together with its not being contagious.

The *ulcerated ſore throat*, however is more difficult to diſtinguiſh from this diſeaſe than any other; and yet the diſtinction is a matter of the greateſt importance, as the method of treatment, according to Dr Withering, ought to be extremely different.—But although, in a number of circumſtances, theſe two diſeaſes bear a very great reſemblance, yet, with a little attention, the one may in general, he thinks, be diſtinguiſhed from the other. From Dr Fothergill's account of the ſore throat attended with ulcers, our author has made out the following characteriſtical circumſtances of the two diſeaſes, contraſted to one another.

Scarlatina Anginoſa.	Angina Gangrenoſa.
Seaſon . . Summer. . Autumn.	*Seaſon*. . Spring . . Winter.
Air. . Hot. . Dry.	*Air*. . Warm . . Moiſt.
Places. High . . Dry . . . Gravelly.	*Places*. Cloſe. . Low . . Damp. . Marſhy.
Subjects. Vigorous. Both ſexes alike . . Robuſt in moſt danger. . . .	*Subjects*. Delicate . . Women and female children. Robuſt adults not in danger.
Skin. Full ſcarlet . . . . ſmooth . . If pimply, the pimples white at the top . . Always dry and hot.	*Skin*. Red tinge . . pimply. . The pimples redder than the interſtices . . bedewed with ſweat toward morning.
Eyes. Shining, equable, intenſe redneſs, rarely watery.	*Eyes*. Inflamed and watery, or ſunk and dead.
Throat. In ſummer, tonſils, &c. little tumefied; no ſlough . . In autumn, more ſwelled. Integuments ſeparating . . Sloughs white.	*Throat*. Tonſils, &c. conſiderably ſwelled and ulcerated . . . Sloughs dark brown.
Breath. Very hot, but not fetid.	*Breath*. Offenſive to the patients and aſſiſtants.
Voice. In ſummer, natural.	*Voice*. Flat and rattling.
Bowels. Regular at the acceſſion.	*Bowels*. . Purging at the acceſſation.
Blood. Buffy. . Firm.	*Blood*. . Florid . . Tender.
Termination. The 3d, 5th, 8th, or 11th day.	*Termination*. No ſtated period.
Nature. Inflammatory.	*Nature*. Putrid.

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It is not pretended, Dr Withering remarks, that all the above contraſted ſymptoms will be met with in every caſe. It is enough, he obſerves, that ſome of them appear; and that if conjoined with the conſideration of the prevailing conſtitution, they enable us to direct that mode of treatment which will moſt contribute to the relief of the ſick.

But notwithſtanding the attention which Dr Withering has beſtowed upon this ſubject, we are ſtill inclined to think, that the diſeaſe which he has ſo accurately deſcribed under the title of *ſcarlatina anginoſa*, is in reality the ſame affection with the malignant ulcerous ſore throat of Huxham and Fothergill. During different epidemics, this diſeaſe, like ſmall-pox and meaſles in different ſeaſons, is conſiderably varied in its appearance. But ſtill there occurs ſuch a ſimilarity as clearly marks the ſameneſs of the affection. And indeed this, as in the caſe of the ſmall-pox, is abundantly demonſtrated, by infection from one contagion giving protection againſt ſucceeding ones, although the appearances be much varied. This has particularly appeared at Edinburgh, where the diſeaſe has of late prevailed as an epidemic on three different years, viz. 1774-5, 1782-3, and 1789-90. During the firſt of theſe, in the greater part of patients, the ſore throats were of a very gangrenous and malignant nature: during the ſecond, the diſeaſe more commonly appeared under the form of what might be called *ſimple ſcarlatina*: and during the third epidemic, the contagion was, if we may be allowed the expreſſion, of an intermediate nature. But it is farther to be remarked, that during every one of thoſe epidemics, when ſeveral children of a family were at the ſame time ſubjected to the infecton, in one the diſeaſe would have been attended with almoſt all the ſymptoms mentioned in the column of *ſcarlatiua anginoſa*, with reſpect to ſkin, eyes, throat, breath, bowels, termination of the affections, &c. In another, would have occurred all the ſymptoms with reſpect to thoſe particulars which he has mentioned under the column of *angina gangrenoſa*. While at the ſame time, in numberleſs inſtances, even in the ſame patient, the diſeaſe at its commencement has ſhown evident marks of an inflammatory, and at its termination of a putrid tendency. And there cannot be a doubt, that both the ſcarlatina anginoſa,

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anginosa, and angina gangrenosa, as described by Fothergill and Huxham have occurred in every season and situation, and have affected persons of every age and constitution not before subjected to either disease.

Causes. Dr Withering affirms, that the immediate cause of this disease is a poison of a peculiar kind, communicable by contagion.

2. That this poison first takes possession of the mucous membrane lining the fauces and the nose; and either by its action upon the secretory glands, or upon the mucus itself, assimulates that mucus to its own nature.

3. That it is from this beginning, and from this only, that it spreads to the stomach, &c. and at length acts upon the system at large.

4. That its first action upon the nerves is of a sedative or debilitating nature.

5. That in consequence of certain laws of the nervous system, when the debilitating effects operate upon the sensorium commune, a reaction takes place; and that this reaction is, *cæteris paribus*, proportioned to the debilitating power.

6. That, in consequence of this reaction of the nervous system, the vibratory motion of the capillary blood vessels dependent thereon is greatly encreased; an unusually large quantity of blood is accumulated in those vessels; the heart and large blood-vessels are deprived of their customary proportion; and hence, though stimulated to more frequent contraction, the pulse must necessarily be feeble.

7. That as violent exertions are followed by debility, upon the cessation of the fever, the capillary vessels, which had acted with such unusual violence, are left in a state of extreme debility, and are long in recovering their tone; hence it is that so many patients afterwards become dropsical.

Dr Withering next proceeds to the consideration of the different remedies, which either are at present in common use or have been recommended as proper in this disease.

Cure. Blood-letting has been recommended by authors; but such was the state of the pulse in this disorder, at least during the summer months, that it was not in any instance thought advisable to take away blood. In some cases, indeed, where the fiery redness of the eyes seemed to demand the use of leeches, they were had recourse to, but never with any advantage. In the harvest months, when the pulse was more firm, and when suffocation seemed to be threatened from the swelling in the fauces, blood-letting was sometimes advised; but still with less advantage than one would have expected in almost any other situation.

Vomiting.] This, our author observes, seems to be the remedy of nature; and he is surprised how it should have been omitted by several authors who have gone before him. Vomiting, he says, most amply fulfils the indications arising both from a consideration of the cause and of the effects; and a liberal use of the remedy he holds forth as the true foundation for successful practice in scarlet fever and sore throat. His common form of emetic is a combination of tartar emetic and ipecacuanha, given in pretty smart doses; and these are to be repeated at least once in 48 hours, and in the worst cases so often as twice in 24 hours.

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Purging.] The action of purgatives is considered by Dr Withering as altogether repugnant to the curative indications in this disease: for the poisons, as formerly remarked, being received into the system by the fauces, the operation of a purge, instead of discharging it, can only promote its diffusion along the alimentary canal; and in fact, we are told, that when even a spontaneous purging supervenes in this disease, the patients sink so amazingly fast, that it is not within the reach of art to support them. When, however, a considerable quantity of acrid matter passing from the fauces into the stomach, makes its way to the rectum, a considerable degree of looseness often takes place. And although evacuations from the system in general by means of cathartics may be hurtful, yet patients often obtain great relief from a free discharge of this matter; and by discharging it, purgatives have the effect even of preventing an evacuation from the system, which would otherwise take place.

Sudorifics. Cordials. Alexipharmics.] None of these remedies were found beneficial. With respect to cordials, Dr Withering observes, that altho' they seem to be indicated by the great loss of strength and feeble pulse, yet the certain consequence of their use always was, an increase of restlessness, of the delirium and of the heat.

Diuretics.] These were found very beneficial. The vegetable fixed alkali is recommended as the most proper article of this kind: a dram or two may be easily swallowed every 4 hours, by giving a small quantity in every thing the patient drinks. Diuretics, however, have been found principally serviceable by practitioners in general in those cases where the urine is observed to be scanty, and where dropsical symptoms have taken place.

Peruvian bark.] No medicine, we are told, ever had a fairer trial in any disease than the Peruvian bark had in this epidemic; for the feeble pulse, great prostration of strength, with here and there a livid spot were thought to be such undeniable evidences of a putrid tendency, that the bark was poured down not with a sparing hand. But this was only at first; for these livid spots and the sloughs in the throat being found to be the effects of inflammation instead of putrefaction, and the bark instead of diminishing, rather increasing these symptoms, it was at last entirely laid aside by Dr Withering in his practice. But although Peruvian bark may not have been successful with a particular epidemic at a particular place; yet from the concurring testimony of many practitioners, it is very commonly found to be productive of good effects: And there is perhaps no remedy in which greater dependence is in general put, particularly in the advanced periods of the disease, where the fœtor is considerable.

Upon the same principles that the bark was prescribed, fixable air was at first likewise advised, but with no evident effects either one way or another. Dulcified acids were also had recourse to, but with no advantage.

Opiates.] These, although recommended by some

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authors for the removal of inquietude and watchfulness, yet in this epidemic, instead of effecting these purposes, always increased the distress of the patient.

Blisters.] In the summer appearance of the disease, blisters were universally detrimental; they never failed to hasten the delirium; and if the case was of the worst kind, they too often confirmed its fatal tendency. But although this may have been the case during the epidemic which Dr Withering describes, it has by no means been generally observed. On the contrary, by the early application of blisters to the external fauces, both the glandular swellings and likewise the discharge from the mouth and fauces have been much diminished; and practitioners have believed, not without probable reason, that the after affections of the throat were less considerable than would otherwise have been the case. Dr Withering allows, that in the autumnal season, when the inflammation was less generally diffused through the body, they were less detrimental; but he thinks that they did not here produce any beneficial effects.

Injected gargles of contrayerva decoction, sweetened with oxymel of squills, &c. were found very beneficial in bringing always large quantities of viscid ropy stuff from the fauces.

The immersion of the feet and legs in warm water, although it did no harm, yet did not either procure sleep or abate the delirium, as it frequently does in other kinds of fever.

As in summer it was found difficult to keep the patients sufficiently cool, they were ordered to lie upon a matrass instead of a feather-bed; a free circulation of air was kept up; and where the patient's strength would admit of it, they were ordered frequently out of doors. Animal food and fermented liquors were denied them, and nothing allowed but tea, coffee, chocolate, milk and water, gruel, barley-water, and such articles.

With respect to the dropsical disorder which so frequently succeeds to this complaint, it was never observed, Dr Withering remarks, when the preceding symptoms had been properly treated.

When called upon to patients in the dropsical state, he began his practice by a dose of calomel at night and a purgative in the morning. When a febrile pulse attended the other symptoms, emetics were useful, as well as the saline draughts and other neutral salts. When great debility, comatose or peripneumonic symptoms occurred, blisters were found very serviceable: but when dropsical symptoms were the principal cause of complaint, small doses of rhubarb and calomel were advised; recourse was also had to diluted solutions of fixed alkalies, squills, Seltzer waters, and other diuretics.

When the urine flows freely, steel and other tonics are recommended; together with gentle exercise, high-seasoned food, wine, and the wearing of flannel in contact with the skin.

Dr Withering concludes his essay with an enumeration of several cases, treated according to the principles above laid down. The successful termination of these cases demonstrates the propriety of the practice which he has recommended; at least for the epidemic under the form in which it then appeared.

Urticaria.

Genus XXXIII. URTICARIA, NETTLE-RASH.

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Febris urticata, *Vog.* 40.
Uredo, *Lin.* 8.
Purpura urticata, *Junck.* 75.
Scarlatina urticata, *Sauv.* sp. 2.
Erysipelatis species altera, *Sydenham*, sect. vi. cap. 6.
Febris scarlatina, et febris urticata, *Meyserey*, Mal. des armées, 291 et seq.

Description. This disease has its English name from the resemblance of its eruption to that made by the stinging of nettles. These little elevations upon the skin in the nettle-rash often appear instantaneously, especially if the skin be rubbed or scratched, and seldom stay many hours in the same place, and sometimes not many minutes. No part of the body is exempt from them; and where many of them rise together, and continue an hour or two, the parts are often considerably swelled, which particularly happens in the face, arms, and hands. These eruptions will continue to infest the skin, sometimes in one place and sometimes in another, for one or two hours at a time, two or three times every day, or perhaps for the greatest part of the 24 hours.—In some persons they last only a few days, in others many months; nay, sometimes the disease has lasted for years with very short intervals.

But though the eruption of the urticaria resembles, as already observed, that produced by the stinging of nettles, it is sometimes accompanied with long wheals, as if the part had been struck with a whip. Whatever be the shape of these eminences, they always appear solid, without having any cavity or head containing either water or any other liquor: and this affords an easy mark whereby this disease may be distinguished from the itch. For it often happens, that the insufferable itching with which this eruption is attended, provokes the patient to scratch the parts so violently, that a small part of the cuticle on the top of these little tumours is rubbed off; a little scab succeeds; and when the swelling is gone down, there is left an appearance hardly to be distinguished from the itch, but by the circumstance just now mentioned. The nettle-rash also further differs from the itch, in not being infectious.

Causes, &c. Dr Heberden is inclined to ascribe this distemper to some mechanical cause outwardly applied to the skin. He observes that most people suffer in a similar manner from the real stinging of nettles. Cowhage, or, as it is corruptly called, *cow-itch*, a sort of phaseolus, or French bean, the pod of which is covered over with a kind of down or hair, and the effect of which upon the skin is much the same as that of nettles; and almost any hairs cut equally short, and sprinkled upon the skin, whenever they happen to stick in it, will make the part itch or smart in such a manner as to give great uneasiness; it is also a considerable time before the skin can be cleared of the finer ones, when once they are strewed upon it.

Reaumur, in the fourth memoir of his History of Insects, describes a species of caterpillars to which belong

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long a ſort of hairs almoſt inviſible to the naked eye, which are eaſily detached, and frequently float in the air round their neſt, though it have not been at all diſturbed. The touch of theſe hairs has a ſimilar effect with the cow-itch; that is, they occaſion intolerable itchings, with little bumps and redneſs, ariſing ſometimes to a ſlight inflammation. Theſe he found would continue four or five days, if the animal or the neſt had been much handled; and though they had not been touched at all, yet, by only walking near their neſts, the ſame effects would be brought on, but for a ſhorter time. Theſe hairs affect the ſkin in this manner by ſticking in it, as he could perceive with a glaſs of a great magnifying power; for with one of a ſmall power they were not viſible. The uneaſy ſenſations cauſed by theſe ſmall wounds, not only, as he ſays, laſt ſeveral days, but move from one part of the body to another; ſo that they will ceaſe upon one wriſt, and immediately begin on the other; from the wriſt they will go to the fingers or the face, or even to the parts of the body which are covered. He ſuppoſes, that the motions of the body, when much of this fine down lies near or upon the ſkin, may drive it from one part to another, or change what was lying there inoffenſively to a ſituation fit to make it penetrate into the ſkin. Neither cold water, nor oil, nor ſpirit of wine, with which the parts affected were bathed, had any effect in removing the itching. He thinks the moſt efficacious remedy which he tried for this complaint was to rub the parts ſtrongly with parſley, which inſtantly leſſened the ſenſations, and after two or three hours, entirely freed the patient from them. It is alſo well known, that many ſpecies of caterpillars, by only walking over the hands, will produce ſomething like this effect on the parts which they touch, and undoubtedly from the ſame cauſe.

Dr Heberden aſks, Is it impoſſible that the nettle-raſh ſhould ariſe from the ſame cauſes, or from others ſimilar, which we miſs by looking too deeply for them in the blood and humours? Such (ſays he) may have been its origin in ſome inſtances, where it has laſted only a few days; but where this affection has continued for ſome years, in perſons who change their linen every day, and who bathe frequently all the time, it can hardly be aſcribed to ſuch an external cauſe. He has obſerved it frequently to ariſe from cantharides: but though it has continued many weeks after the removal of the bliſter, yet it might be ſuſpected that this aroſe from the fine ſpiculæ of the cantharides ſticking all this time about the ſkin; it being cuſtomary to ſtrew much of the dry powder of the cantharides over the bliſter-plaſter, whence it may readily be carried to other parts of the body. But it is certain that ſimilar effects will ſometimes follow the internal uſe of wild valerian root, or the eating of fiſh not ſufficiently dreſſed; muſcles, ſhrimps, and even honey, and the kernels of fruits, will alſo ſometimes produce ſymptoms of a ſimilar kind. But whatever be its cauſe, Dr Heberden never ſaw any reaſon to ſuppoſe that the nettle-raſh had in any way vitiated the humours to ſuch a degree as to require the uſe of internal remedies; and if the itching could be certainly and expeditiouſly allayed, there would be no occaſion for any farther cure. He concludes this hiſtory of the diſorder with a caſe communicated to him by Dr Monſey, phyſician of Chelſea-college, and in which the diſeaſe appeared with uncommon violence.

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W. A. aged near 30, of a thin ſpare habit, was ſeized with a diſorder attended with ſymptoms of a very uncommon kind. Whenever he went into the air, if the ſun ſhined bright, he was ſeized with a tickling of his fleſh on thoſe parts expoſed to the ſun: this tickling, by his continuing in the air, increaſed to a violent itching, attended with great heat and pain: the ſkin would then be almoſt as red as vermilion, and thicken like leather; and this remained till he went out of the open air, and then abated in about 15 or 20 minutes. This happened only when the ſun was above the horizon; at other times he was what he called *quite well*.—But it was not owing to the heat of the ſun; for the ſun in winter affected him full as much, if not more, and the heat of the fire had no ſuch effect. Thus he was confined to the houſe for 10 years. He tried ſeveral hoſpitals, and had advices from many phyſicians, without the leaſt abatement of his complaints. At laſt it was agreed by a conſultation of phyſicians, that he ſhould try dipping in ſalt-water; which he did at Yarmouth for 13 weeks, without any viſible amendment. One hot day, having pulled off his clothes and gone into the ſea in the middle of the day, the heat diffuſed itſelf ſo violently all over his body, that, by the time he had put on his clothes, his eye-ſight began to fail, and he was compelled to lie down upon the ground to ſave himſelf from falling. The moment he lay down, the faintneſs went off: upon this he got up again; but had no ſooner ariſen, than he found himſelf in the former condition: he therefore lay down again, and immediately recovered. He continued alternately getting up and lying down, till the diſorder began to be exhauſted, which was in about half an hour; and he was frequently obliged to have recourſe to the ſame expedient.

Having at laſt accidentally met with Dr Monſey, this phyſician queſtioned him concerning the cauſe of the diſorder; but nothing could be gueſſed at, excepting that the patient owned he had one winter lived entirely upon bullock's liver and porter, from inability to purchaſe better victuals. A comrade lived with him at that time, on the ſame proviſions; and he alſo was affected in a ſimilar manner, though in a leſs degree, and had recovered. This patient was then firſt put upon a courſe of Dover's ſweating powder without any effect, and, afterwards tried a courſe of nitrous ones with the ſame bad ſucceſs. At laſt Dr Monſey determined to try the effect of mercury, which happily proved effectual in removing this obſtinate and uncommon diſtemper. The patient began with taking five grains of calomel for three nights running, and a cathartic next morning. In this courſe he went on for near a fortnight, at the end of which he found himſelf very ſenſibly relieved. This encouraged him to go on rather too boldly, by which means a ſlight ſalivation enſued; however, that went off ſoon, and in about ſix weeks he was quite well.—Some time after, he was threatened with a return of his diſorder; but this was effectually relieved by a doſe of calomel, which he had afterwards occaſion to repeat for the ſame reaſon, and with the ſame ſucceſs;

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success; but at last the disorder seemed to be radically cured, by his having no further symptoms of a relapse.

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Pemphigus, *Sauv.* gen. 93. *Sag.* 291.
Morta, *Lin.* 1.
Febris bullosa, *Vog.* 41.
Pemphigus major, *Sauv.* sp. 1.
Exanthemata serosa, *C. Pison.* Obs. 150.
Febris pemphygodes, *Ephem. Germ.* D. I. A. viii. Obs. 56.
Pemphigus castrensis, *Sauv.* sp. 2.
Febres syneches, cum vesiculis per pectus et collum sparsis, *Morton.* App. ad Exerc. II.
Pemphigus Helveticus, *Sauv.* sp. 3. *Langhans* in Act. Helvet. vol. ii. p. 260. et in *Beschreibung* des Siementhals, Zurich 1753.

This is a very rare disease, insomuch that Dr Cullen declares he never saw it. He declines taking the descriptions of foreign physicians: we shall therefore content ourselves with giving an instance of this very uncommon distemper, as it was observed in the infirmary at Aberdeen, and was treated by the late Dr David Stuart, then physician to that hospital, who soon after published an account of it in the Edinburgh Medical Commentaries. A private soldier of the 3d regiment, aged eighteen years formerly a pedlar, and naturally of a healthy constitution, was received into the hospital at Aberdeen on the 20th of April. About twenty days before that, he had been seized with the measles when in the country; and, in marching to town, on the second day of their eruption, he was exposed to cold; upon which they suddenly disappeared.

Having arrived at Aberdeen, he was quartered in a damp, ill-aired, under ground apartment. He then complained of sickness at stomach, great oppression about the præcordia, head-ach, lassitude, and weariness, on the least exertion; with stiffness and rigidity of his knees and other joints. The surgeon of the regiment visited him: he was purged, but with little benefit. About ten days before, he observed on the inside of his thighs a number of very small, distinct, red spots, a little elevated above the surface of the skin, and much resembling the first appearance of small-pox. This eruption gradually spread itself over his whole body, and the pustules continued every day to increase in size.

Upon being received into the hospital, he complained of head-ach, sickness at stomach, oppression about the præcordia, thirst, sore throat, with difficulty of swallowing; his tongue was foul, his skin felt hot and feverish; pulse from 110 to 120, rather depressed: belly costive: eyes dull and languid, but without delirium. The whole surface of his skin was interspersed with vesicles, or phlyctænæ, of the size of an ordinary walnut; many of them were larger, especially on the arms and breast. In the interstices, between the vesicles, the appearance of the skin was natural, nor was there any redness round their base; the distance from one to another was from half an inch to a handbreadth or more. In some places two or three were joined together, like the pustules in the confluent small-pox. A few vesicles had burst of themselves, and formed a whitish scab or crust. These were mostly on the neck and face; others showed a tolerably laudable pus. However, by far the greatest number were perfectly entire, turgid, and of a bluish colour. Upon opening them, it was evident that the cuticle elevated above the cutis, and distended with a thin, yellowish, semipellucid serum, formed this appearance. Nor was the surface of the cutis ulcerated or livid; but of a red florid colour, as when the cuticle is separated by a blister, or superficial burning. No other person laboured under a similar disease, either in the part of the country from which he came, or when he resided in Aberdeen.

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This case was treated in the following manner. The largest of the vesicles were snipped, and dressed with *unguent. e lap. calaminari.* In the evening he was vomited with a solution of tartar emetic, given in small quantities and at intervals. This also procured two loose stools. And he was ordered for drink, water-gruel acidulated with lemon juice.

"April 16. He still complained of sickness, some oppression about his breast, and sore throat; he had slept little during the night; his tongue was foul and blackish; his skin, however, was not so hot as the preceding day; his urine was high-coloured, but had the appearance of separation; his pulse 90, and soft; most of the sores on the trunk of the body looked clean. Others, particularly where the vesicles were confluent, seemed beginning to ulcerate, and to have a bluish sublivid appearance. They were dressed afresh with cerate, and he was ordered the following medicines:

R. Decoct. Cort. Peruvian. vi. Vini rubr. Lusitan. ℥iii. M. Hujus mixturæ capiat ʒß. tertia quaque hora

"His acidulated drink was continued; and on account of the very offensive smell on approaching near him, some vinegar was placed in a bason before the bed, and sprinkled on the floor; and the room was kept properly aired.

"April 17. His sores looked tolerably clean, unless on his arms and thighs; where they were livid, a little ulcerated, and discharged a bloody ichor.

"His head-ach, sickness, &c. were mostly gone; his tongue was rather cleaner; pulse 68, and soft. As the decoction of the bark sat easily on his stomach, the following prescription was ordered:

R. Pulv. subtiliss. Cort. Peruv. ʒß. Vini rubri Lusitan. aquæ fontan. āā ʒss. M. ft. Haust. tertia quaque hora repetend.

The acidulated drink was continued, and fresh dressings applied to the sores.

"April 18. The little ulcers in his arms and thighs still discharged a bloody ichor, and looked ill: his other complaints were better; pulse 82. The bark had not nauseated him, and it was continued as well as his former drink.

"April 19. His sores looked much cleaner and better; the fever was gone, his pulse natural, and he had no complaint but weakness and troublesome itching of the skin: The Peruvian bark, &c. were continued.

"April 20. Some of the ulcers still poured forth a bloody ichor; most of them, however, looked well, and had begun to heal—fever gone—medicines continued.

"From the 21st of April he went on gaining strength, and his sores appeared to heal fast; he was desired to take

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take only four doses every day; and by the 27th his sores, &c. were totally dried up—he had no complaint, and was dismissed cured."

Since the publication of this case of pemphigus by Dr Stuart, observations on this disease have been published by Dr Stephen Dickson of Dublin in the Transactions of the Royal Irish Academy. In these observations, an account is given of six different cases which Dr Dickson has had an opportunity of seeing. Judging from these, Dr Dickson thinks that Dr Cullen's definition of this disease requires correction; and that it ought to be defined, "a fever accompanied with the successive eruption, from different parts of the body, internal as well as external, of vesicles about the size of an almond, which become turgid with a faintly yellowish serum, and in three or four days subside."

From the cases which have fallen under Dr Dickson's observation, he concludes, that the disease varies considerably as to its mildness or malignity. In three of the cases which he has seen, the symptoms were extremely mild, but in the other three strong symptoms of putrescency were manifested, and the life of the patient was in great danger. With respect to the method of cure, he is of opinion, that the general symptoms of weakness, and tendency to putrefaction, obviously point out the proper treatment. Nourishment must be supplied, and the Peruvian bark and wine carefully administered; and when vesicles appear on internal parts, irritation must be guarded against by opiates, demulcents, and gentle laxatives.

Some additional observations on the subject of pemphigus have lately been published in the London Medical Journal by Mr Thomas Christie. From a case which Mr Christie describes, he is disposed to agree with Dr Dickson in thinking that sometimes at least pemphigus is not contagious. He remarks, however, that the pemphigus described by some foreign writers was extremely infectious; which he thinks this may lead to a division of the disease into the two species, the pemphigus simplex and complicatus; both of which, but especially the last, seem to vary much with respect to mildness and malignity.

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Genus XXXV. APHTHA.
The Thrush.

Aphtha, *Sauv.* gen. 100. *Lin.* 9. *Sag.* 298. *Boerh.* 978. *Hoffm.* II. 478. *Junck.* 137.
Febris aphthosa, *Vog.* 44.

The only idiopathic species is the thrush to which infants are subject; (Aphtha lactucinien, *Sauv.* sp. 1.)

The aphthæ are whitish or ash-coloured pustules, invading the uvula, fauces, palate, tonsils, inside of the cheeks, gums, tongue, and lips. They for the most part begin at the uvula, sending forth a glutinous mucus, and the pustules covering all or the greatest number of the parts abovementioned with a thick whitish crust adhering most tenaciously. This crust does not induce an eschar on the parts on which it lies by eating into them, but comes off in whole pieces after the pustules have arrived at maturity. This will often happen in a short time, so that the throat and internal parts of the mouth are frequently observed to be clean which a few years before were wholly covered with white crusts. Neither is this disease confined to the throat and fauces, but is said to affect the œsophagus, stomach, and all parts of the alimentary canal. Of this indeed there is no other proof, than that, after a great difficulty of swallowing, there is sometimes an immense quantity of aphthæ evacuated by stool and vomiting, such as the mouth could not be thought capable of containing.

Aphtha.

Causes, &c. The aphthose fever seems to be produced by cold and moisture, as it is found only in the northern countries, and especially in marshy places; and in them the aphthæ often appear without any fever at all.

Prognosis. There is no symptom by which the coming out of aphthæ can be foretold, though they are common in many fevers; but they themselves are in general a bad symptom, and always signify a very tedious disorder: the danger denoted by them is in proportion to the difficulty of deglutition; and a diarrhœa accompanying them is likewise bad. This indeed generally carries off old people when they become affected with aphthæ. The dark-coloured aphthæ also are much more dangerous than such as are of a brown or ash colour; but it is a good sign when the appetite returns, and the dark-coloured ones are succeeded by others of a whiter colour. Neither are those which are unaccompanied with fever so dangerous as the other kind.

Cure. As the aphthæ are seldom a primary disease, we must generally endeavour to remove the disorder upon which they depend, after which they will fall off; but in the mean time we are not to neglect applications to the aphthæ themselves, such as detergent and softening gargles made of the decoction of figs, with the addition of honey of roses, a little vinegar, and some tincture of myrrh.

Order IV. HÆMORRHAGIÆ. 234
Hæmorrhagies.

Hæmorrhagiæ, *Vog.* Class II. Ord. I. *Hoffm.* II. 194. *Junck.* 5.
Sanguifluxus, *Sauv.* Class IX. Ord. I. *Sag.* Class V. Ord. I.

Genus XXXVI. EPISTAXIS. 235
Bleeding at the Nose.

Hæmorrhagia, *Sauv.* gen. 239. *Lin.* 173. *Sag.* gen. 174.
Hæmorrhagia narium, *Hoffm.* II. 196. *Junck.* 6.
Hæmorrhagia plethorica, *Sauv.* sp. 2. *Hoffm.* II. 198.

The other species enumerated by authors are all symptomatic.

Description. The milder species of this hæmorrhagy comes on more frequently in summer than in winter, and for the most part without giving any warning, or being attended with any inconvenience; but the less benign kind is preceded by several remarkable symptoms. These are, congestions of the blood sometimes in one part and sometimes in another, and which are often very troublesome in the sides of the head; there is a redness of the cheeks; an inflation of the face, and of the vessels of the neck and temples; a *tinnitus aurium*; a heavy pain of the eyes, with a prominence

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minence, dryneſs, and ſparks; there is a vertiginous affection of the head, with an itching of the noſtrils, and a ſenſe of weight, eſpecially about the root of the noſe. In ſome the ſleep is diſturbed with dreams about blood, fire, &c. Frequently the belly is coſtive, there is a diminution of the quantity of urine, a ſuppreſſion of ſweat, coldneſs of the lower extremities, and tenſion of the hypochondria, eſpecially the right one.

Cauſes, &c. This hæmorrhagy; may occur at any time of life: but moſt commonly happens to young perſons, owing to the peculiar ſtate of the ſyſtem at that time. Sometimes, however, it happens after the ἀκμὴ and during the ſtate of manhood, at which time it is to be imputed to a plethoric ſtate of the ſyſtem; to a determination of the blood, by habit, to the veſſels of the noſe; or to the particular weakneſs of theſe veſſels.

In all theſe caſes the diſeaſe may be conſidered as an arterial hæmorrhagy, and depending upon an arterial plethora; but it ſometimes occurs in the decline of life, and may then be conſidered as the ſign of a venous plethora in the veſſels of the head. It often happens at any period of life in certain febrile diſeaſes, which are altogether or partly of an inflammatory nature, and which ſhow a particular determination of the blood to the veſſels of the head, As by this evacuation, other diſeaſes are often removed, it may on theſe occaſions be deemed truly *critical*. It happens to perſons of every conſtitution and temperament; but moſt frequently to the plethoric and ſanguine, and more commonly to men than women.

Prognoſis. In young people, the bleeding at the noſe may be conſidered as a ſlight diſeaſe, and ſcarce worth notice. But, even in young perſons, when it recurs very frequently and in great quantity, it is alarming; and is to be conſidered as a mark of an arterial plethora, which in the decline of life may give the blood a determination to parts from which the hæmorrhagy would be more dangerous. And this will require more particular attention as the marks of plethora and congeſtion preceding the hæmorrhagy are more conſiderable, and as the flowing of the blood is attended with a more conſiderable degree of febrile diſorder. Theſe conſequences are more eſpecially to be dreaded, when the epiſtaxis happens to perſons after their ἀκμὴ returning frequently and violently. Even in the decline of life, however, it may be conſidered as in itſelf very ſalutary; but at the ſame time it is a mark of a dangerous ſtate of the ſyſtem, i. e. of a ſtrong tendency to a venous plethora in the head, and it has accordingly been often followed by apoplexy, palſy, &c. When it happens in febrile diſeaſes, and is in pretty large quantity, it may be generally conſidered as critical and ſalutary; but it is very apt to be too profuſe, and thus becomes dangerous. It ſometimes occurs during the eruptive fever of ſome exanthemata, and is in ſuch caſes ſometimes ſalutary; but if theſe exanthemata be accompanied with any putrid diſpoſition, this hæmorhagy, as well as artificial blood-lettings, may have a very bad tendency.

Cure. The treatment in caſes of epiſtaxes may be referred to two heads. *1ſt*, The treatment during the time of the diſcharge; and, *2dly*, The treatment after the diſcharge is ſtopt, with the view of preventing the return of it. During the former of theſe periods, it is neceſſary in the firſt place to conſider whether the diſcharge ſhould be left to its natural courſe, or ſtopped by artificial means. In determining this queſtion, regard muſt be paid to the quantity of the diſcharge; the appearance of the blood; the conſtitution with which epiſtaxis occurs; the former habit of the patient; and the conſequences which reſult from the diſcharge. When, from due conſideration of theſe circumſtances, there is reaſon to fear that further evacuation would be attended with bad conſequences, though this diſeaſe has been generally thought very ſlight, it ſhould ſeldom be left to the conduct of nature; and in all caſes it ſhould be moderated by keeping the patient in cool air, by giving cold drink, by keeping the body and head erect, by avoiding any blowing of the noſe, ſpeaking, or other irritation; and if the blood has flowed for ſome time without ſhowing any tendency to ſtop, we are to attempt the ſuppreſſion of the hæmorrhagy, by preſſing the noſtril from which the blood flows, waſhing the face with cold water, or applying this to ſome other parts of the body. Theſe meaſures Dr Cullen judges to be proper even on the firſt attacks, and in young perſons where the diſeaſe is the leaſt hazardous: but they will ſtill be more requiſite if the diſeaſe frequently recurs without any external violence; if the returns happen to perſons diſpoſed to a plethoric habit; and more particularly if the ſigns of plethora appear in the ſymptoms preceding the diſcharge.

Epiſtaxis.

When the bleeding is ſo profuſe that the pulſe becomes weak and the face pale, every means muſt be uſed to put a ſtop to it, and that whether the patient be young or old. Beſides thoſe methods abovementioned, we muſt uſe aſtringents both internal and external; but the latter are the moſt powerful, and the choice of theſe may be left to the ſurgeon. The internal aſtringents are either vegetable or foſſil; but the vegetable aſtringents are ſeldom powerful in the cure of any hæmorrhagies except thoſe of the alimentary canal. The foſſil aſtringents are more active, but differ conſiderably in ſtrength from one another.—The chalybeates appear to have little ſtrength: the preparations of lead are more powerful; but cannot be employed, on account of their pernicious qualities, unleſs in caſes of the utmoſt danger. The *tinctura ſaturnina*, or *antiphthiſica*, is a medicine of very little efficacy, either from the ſmall quantity of lead it contains, or from the particular ſtate in which it is. The ſafeſt and at the ſame time the moſt powerful aſtringent ſeems to be alum.

For ſuppreſſing this and other hæmorrhages, many ſupperſtitious remedies aud charms have been uſed, and ſaid to have been employed with ſucceſs. This has probably been owing to the miſtake of the by-ſtanders, who have ſuppoſed that the ſpontaneous ceſſation of the hæmorrhagy was owing to their remedy. At the ſame time Dr Cullen is of opinion, that ſuch remedies have ſometimes been uſeful, by impreſſing the mind with horror or dread. Opiates have ſometimes proved ſucceſsful in removing hæmorrhagies; and when the fulneſs and inflammatory diatheſis of the ſyſtem have been previouſly taken off by bleeding, they may, in Dr Cullen's opinion, be uſed with ſafety and advantage. Ligatures have been applied upon the limbs, for retarding the return of the venous blood from

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from the extremities; but their use seems to be ambiguous. In the case of profuse hemorrhagies, no care is to be taken to prevent the patient from fainting, as this is often the most certain means of stopping them.

236 GENUS XXXVII. HÆMOPTYSIS.
SPITTING of BLOOD.

Hæmoptysis, *Sauv.* gen. 240. *Lin.* 179. *Vog.* 84. *Sag.* gen. 175. *Junck.* 8.
Hæmoptoë, *Boerh.* 1198.
Sanguinis fluxus ex pulmonibus, *Hoffm.* II. 202.

Sp. I. HÆMOPTYSIS from *Plethora.*

Sp. II. HÆMOPTYSIS, from *External Violence.*

Hæmoptysis accidentalis, *Sauv.* sp. 1.
Hæmoptysis habitualis, *Sauv.* sp. 2.
Hæmoptysis traumatica, *Sauv.* sp. 12.

Sp. III. HÆMOPTYSIS with *Phthisis.*

Hæmoptysis phthisica, *Sauv.* sp. 9.
Hæmoptysis ex tuberculo pulmonum, *Sauv.* sp. 10.

Sp. IV. *The Calculous HÆMOPTYSIS.*

Hæmoptysis calculosa, *Sauv.* sp. 14.

Sp. V. *The Vicarious HÆMOPTYSIS.*

Hæmoptysis catamenialis, *Sauv.* sp. 4.
Hæmoptysis periodica, *Sauv.* sp. 5.

Description. This hemorrhagy commonly begins with a sense of weight and anxiety in the chest, some uneasiness in breathing, pain of the breast or other parts of the thorax, and some sense of heat under the sternum; and very often it is preceded by a saltish taste in the mouth. Immediately before the appearance of blood, a degree of irritation is felt at the top of the larynx. The person attempts to relieve this by hawking, which brings up a little florid and somewhat frothy blood. The irritation returns; and in the same manner blood of a similar kind is brought up, with some noise in the wind-pipe, as of air passing through a fluid. Sometimes, however, at the very first, the blood comes up with coughing, or at least somewhat of coughing, and accompanies the hawking abovementioned.

The blood is sometimes at first in very small quantity, and soon disappears; but in other cases, especially when it frequently recurs, it is in greater quantity, and often continues to appear at times for several days together. It is sometimes profuse, but rarely in such quantity as either by its excess or by a sudden suffocation to prove immediately mortal.

It is not always easy to discover whether the blood evacuated by the mouth proceeds from the internal surface of the mouth itself, from the fauces or adjoining cavities of the nose, from the stomach, or from the lungs. It is, however, very necessary to distinguish the different cases; and for this Dr Cullen offers the following considerations.

1. When the blood proceeds from some part of the internal surface of the mouth, it comes out without any hawking or coughing; and generally, upon inspection, the cause is evident.

2. When blood proceeds from the fauces, or adjoining cavities of the nose, it may be brought out by hawking, and sometimes by coughing. In this case there may be a doubt concerning its real source, and the patient may be allowed to please himself with the thoughts that the blood does not come from the lungs. But the physician must remember that the lungs are much more frequently the source of an hemorrhagy than the fauces. The latter seldom happens but to persons who have before been liableto an hemorrhagy from the nose, or to some evident cause of erosion; and in most cases, by looking into the fauces, the distillation of the blood from thence will be perceived.

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3. When blood proceeds from the lungs the manner in which it is brought up will commonly show from whence it comes; but, independent of that, it may also be known from the causes of hæmoptysis from the lungs, to be afterwards mentioned, having preceded.

4. When vomiting accompanies the throwing out of blood from the mouth, we may generally know the source from whence it proceeds, by considering that blood does not proceed so frequently from the stomach as from the lungs; that blood proceeding from the stomach commonly appears in greater quantity than from the lungs. The pulmonary blood also is usually of a florid colour, and mixed with a little frothy mucus only; but the blood from the stomach is of a darker colour, more grumous, and mixed with the other contents of the stomach, The coughing or vomiting, as the one or the other happens first to arise, may sometimes point out the source of the blood; and this hath also its peculiar antecedent signs and causes.

Causes, &c. An hæmoptysis may be produced at any time of life by external violence; and, in adult persons, while the arterial plethora prevails in the system, *i. e.* from the age of 16 to 35, an hæmoptysis may at any time be produced merely by a plethoric state of the lungs. More frequently, however, it arises from a faulty proportion between the capacity of the lungs and that of the rest of the body. Thus it is often an hereditary disease, which implies a peculiar and faulty conformation.

This disease especially happens to persons who discover the smaller capacity of their lungs by the narrowness of their chest, and by the prominence of their shoulders; which last is a mark of their having been long liable to a difficulty of respiration. In such cases, too, the disease very frequently happens to persons of a sanguine temperament, in whom particularly the arterial plethora prevails. It happens also to persons of a slender delicate make, of which a long neck is a mark; to persons of much sensibility and irritability, and therefore of quick parts; to persons who have formerly been liable to hemorrhagies from the nose; to those who have suffered a suppression of any usual hemorrhagy; the most frequent instance of which is in females, who have suffered a suppression of their menstrual flux; and, lastly, to persons who have suffered the amputation of any considerable limb.

All this constitutes the predisponent cause of hæmoptysis; and the disease may happen merely from the predisponent cause arising to a considerable height. But in those who are already predisposed, it is often brought on by the concurrence of various occasional and

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and exciting causes. One of these, and perhaps a frequent one is external heat; which, even when in no great degree, brings on the disease in spring, and the beginning of summer, while the heat rarifies the blood more than it relaxes the solids, which had before been contracted by the cold of winter. Another exciting cause is a sudden diminution of the weight of the atmosphere, especially when concurring with any effort in bodily exercise. The effort too, alone, may often be the exciting cause in those who are already predisposed; and more particularly any violent exercise of respiration. In the predisposed, also the disease may be occasioned by any degree of external violence.

Prognosis. Hæmoptysis may sometimes be no more dangerous than a hemorrhagy from the nose; as when it happens to females, in consequence of a suppression of their menses; when, without any marks of predisposition, it arises from external violence; or, from whatever cause arising, when it leaves no cough, dyspnœa, or other affection of the lungs, behind it. But, even in these cases, a danger may arise from too large a wound being made in the vessels of the lungs, from any quantity of red blood being left to stagnate in the cavity of the bronchiæ, and particularly from any determination of the blood being made into the vessels of the lungs, which by renewing the hemorrhagy may have these consequences.

Cure. In the treatment of this disease, with a view of stopping the discharge, it is first necessary to have recourse to those measures which tend to diminish the impetus by which the blood is expelled. This is to be effected by a removal of plethora when it exists; by diminishing the general impetus of circulation; by diminishing local increased action when it takes place in the vessels of the lungs; and by producing a determination of blood to other parts of the system remote from the lungs. But besides practices diminishing impetus, it is often also necessary to employ such as augment the resistance to the passage of blood through the ruptured vessels of the lungs. With these views a variety of practices may be employed, particularly blood-letting, astringents, refrigerants, sedatives, and the like.

On this subject Dr Cullen differs from those who prescribe chalybeates and the Peruvian bark in the cure of hæmoptysis. Both of these, he observes, contribute to increase the phlogistic diathesis then prevailing in the system, and the hæmoptysis from predisposition is always accompanied with such a diathesis. Instead of these, therefore, he recommends blood-letting in greater or smaller quantity, and more or less frequently repeated as the symptoms shall direct. At the same time cooling purgatives are to be employed, and every part of the antiphlogistic regimen is to be strictly enjoined. In the London Medical Observations, the use of nitre is greatly recommended by Dr Dickson, to whom its efficacy was made known by Dr Letherland, physician to St Thomas's hospital. The most commodious method of exhibiting it he found was in an electuary. Four ounces of conserve of roses were made into an electuary with half an ounce of nitre; of which the bulk of a large nutmeg was directed to be given, four, six, or eight times a day, according to the urgency of the case. The good effects of this, he tells us, have often astonished him; and when given early in the disease, he says he can depend as much upon it for the cure of an hæmoptysis, as on the bark for the cure of an intermittent. He agrees with Dr Cullen, however, that in those cases where there is any hardness in the pulse, and which almost always happens, there is a necessity for venesection. A cool regimen, and quiet of body and mind, are certainly useful; but Dr Cullen observes, that some kinds of gestation, such as sailing and travelling in an easy carriage on smooth roads, have often proved a remedy. When the cough is very troublesome, it is absolutely necessary to exhibit frequently a small dose of an opiate. Dr Dickson also informs us, that the nitre joined with spermaceti, or *pulv. e tragacanth. comp.* has produced equally good effects with the electuary abovementioned; in the composition of which he at first considered the conserve only as a vehicle for the nitre, though he means not to insinuate that the former is totally destitute of efficacy.

Hæmoptysis.

When this hemorhagy has resisted other modes of cure, and there is reason to apprehend, even from the mere quantity of blood evacuated, that the patient may sink under the discharge, blisters, particularly when applied to the breast, are often had recourse to with great advantage; and the vitriolic acid, properly diluted, both as an astringent and refrigerant, is often employed with very good effects.

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Pulmonary Consumption.

Phthisis, *Sauv.* gen. 276. *Lin.* 208. *Vog.* 319. *Sag.* 101. *Junck.* 33.
Phthisis pulmonis, *Boerh.* 1196.
Affectio phthisica, sive tabes pulmonalis, *Hoffm.* II. 284.

Sp. I. The *Incipient Phthisis*, without expectoration of *Pus*. 238

Phthisis incipiens, *Morton.* Phisiolog. L. II. cap. 3.
Phthisis sicca, *Sauv.* sp. I.

Sp. II. The *Confirmed Phthisis*, with an expectoration of *Pus*. 239

Phthisis confirmata *auctorum.*
Phthisis humida, *Sauv.* sp. 2.

Sometimes, notwithstanding all the care we can take, the hæmoptysis will degenerate into a phthisis pulmonalis, or consumption of the lungs; and sometimes an hæmoptysis will be the consequence of this dangerous disorder. It has been indeed supposed, that an ulceration of the lungs or phthisis was the natural and almost necessary consequence of an hæmoptysis: but, according to Dr Cullen, this is in general a mistake; for there are many instances of an hæmoptysis from external violence without being followed by any ulceration. The same thing has often been observed where the hæmoptysis arose from an internal cause; and this not only in young persons, when the disease returned for several times, but when it has often recurred during the course of a long life; and it may easily be conceived, that a rupture of the vessels of the lungs, as well as of the vessels of the nose, may be sometimes healed. The causes of phthisis, therefore, Dr Cullen reduces to five heads. 1. An hæmoptysis. 2. A suppuration of the lungs in consequence of a pneu-

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pneumonia. 3. A catarrh. 4. An asthma; and, 5. Tubercles.

1. When a phthisis arises from an hæmoptysis, it is probable that it is occasioned by particular circumstances; and what these circumstances are, may not always be easily known. It is possible, that merely the degree of rupture, or frequently repeated rupture, preventing the wound from healing, may occasion an ulcer; or it is possible, that red blood effused, and not brought up entirely by coughing, may, by stagnating in the bronchiæ, become acrid, and erode the parts. But these hypotheses are not supported by any certain evidence; and from many observations we are led to think, that several other circumstances must concur in producing the disease from hæmoptysis.

2. The second cause of an ulceration of the lungs mentioned above is a suppuration formed in consequence of pneumonia. When a peneumonia, with symtoms neither very violent nor very slight, has continued for many days, it is to be feared it will end in a suppuration: but this is not to be determined by the number of days; for, not only after the fourth, but even after the tenth day, there have been examples of a peneumonia ending by a resolution; and if the disease, has suffered some intermission, and again recurred there may be instances of a resolution happening at a much later period from the beginning of the disease than that just now mentioned, But, if a moderate disease, in spite of proper remedies employed, be protracted to the 14th day without any considerable remission, a suppuration is pretty certainly to be expected; and it will be more certain still, if no signs of resolution have appeared, or if an expectoration which had appeared shall have again ceased, and the difficulty of breathing has continued or increased, while the other symptoms have been rather abated.

That in a pneumonia, the effusion is made which may lay the foundation of a suppuration, may be concluded from the difficulty of breathing becoming greater when the patient is in a horizontal posture, or when the patient can lie more easily on the affected side. That, in such cases, a suppuration is actually begun, may be inferred from the patient's being frequently affected with slight cold shiverings, and with a sense of cold felt sometimes in one sometimes in another part of the body. We form the same conclusion also from the state of the pulse, which is commonly less frequent and softer, but sometimes quicker than before. That a suppuration, is already formed, may be inferred from there being a considerable remission of the pain which had before subsisted; while with this the cough and especially the dispnœa continue, and are rather increased. At the same time the frequency of the pulse is rather increased, the feverish state suffers considerable exacerbations every evening, and by degrees a hectic fever in all its circumstances comes to be formed.

In this state of symptoms, we conclude very confidently, that an abscess, or, as it is called, a *vomica*, is formed in some part of the pleura, and most frequently in that portion of it investing the lungs. Here purulent matter frequently remains for some time, as if enclosed in a cyst; but commonly not long before it comes to be either absorbed and transfered to some other part of the body, or breaks through into the cavity of the lungs, or into that of the thorax. In the latter case it produces the disease called *empyema*, but it is when the matter is poured into the cavity of the bronchiæ that it properly constitutes the phthisis pulmonalis. In the case of empyema, the chief circumstances of a phthisis are indeed also present: but we shall here consider only that case in which the abscess of the lungs gives occasion to a purulent expectoration.

Phthisis.

An abscess of the lungs, in consequence of pneumonia, is not always followed by a phthisis; for sometimes a hectic fever is not formed; the matter poured into the bronchiæ is a proper and benign pus, which frequently is coughed up very readily, and spit out; and though this purulent expectoration should continue for some time, if it be without hectic fever, the ulcer soon heals, and every morbid sypmtom disappears. This has so frequently happened, that we may conclude, that neither the access of the air, nor the constant motion of the lungs, will prevent an ulcer of these parts from healing if the matter of it be well conditioned. An abscess of the lungs, therefore, does not necessarily produce the phthisis pulmonalis; and if it be followed by such a disease, it must be in consequence of particular circumstances which corrupt the purulent matter produced, render it unsuitable to the healing of the ulcer, and at the same time make it afford an acrimony, which, absorbed, produces a hectic fever and its consequences.

The corruption of the matter of such abscesses may be owing to several causes; as, 1. That the matter effused during the inflammation had not been a pure serum fit to be converted into a laudable pus, but had been joined with other matters which prevented that and gave a considerable acrimony to the whole. Or 2. That the matter effused and converted into pus, merely by long stagnation in a vomica, or by its connection with an empyema, had been so corrupted as to become unfit for the purpose of pus in the healing of the ulcer. These seem to be possible causes of the corruption of matter in abscesses, so as to make it the occasion of a phthisis in persons otherwise sound; but it is probable that a pneumonic abscess especially produces phthisis when it happens to persons previously disposed to that disease, and therefore only as concurring with some other causes of it.

3. The third cause supposed to produce a phthisis is a catarrh; which, in many cases, seems in length of time to have the expectoration of mucus proper to it gradually changed to an expectoration of pus; and at the same time by the addition of a hectic fever, the disease which was at first a pure catarrh, is changed into a phthisis. But this supposition is, in the opinions at least of some physicians, liable to several difficulties. The catarrh is properly an affection of the mucous glands of the trachea and bronchiæ analogous to the coryza and less violent kinds of cynanche tonsillaris, which very seldom end in suppuration. And although a catarrh should be disposed to do so, the ulcer produced might readily heal up, as it does in the case of a cynanche tonsillaris; and therefore should not produce a phthisis.

Further, the catarrh, as purely the effect of cold, is generally a mild disease as well as of short duration; and, according to Dr Cullen, there are at most but very few of the numerous cases of it, which can be said

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to have ended in a phthisis. In all these cases in which this seems to have happened, he thinks it probable that the persons affected were peculiarly predisposed to phthisis; and the beginning of phthisis so often resembles a catarrh, that it may have been mistaken for such a disease. It often happens also, to increase the fallacy, that the application of cold, which is the most frequent cause of catarrh, is also frequently the exciting cause of the cough, which proves to be the beginning of a phthisis.

Many physicians have supposed that an acrimony of the fluids eroding some of the vessels of the lungs is a frequent cause of ulceration and phthisis; but this appears to Dr Cullen to be a mere supposition. He acknowledges, that in many cases an acrimony subsisting in some part of the fluids is the cause of the disease; but observes that it is at the same time probable, that this acrimony operates by producing tubercles, rather than by any direct erosion.

But notwithstanding these objections, experience affords numerous examples of cases in which a disease long subsisting under the form of catarrh has at last degenerated into phthisis, and proved fatal from supervening hectic fever. It must, however, at the same time be allowed, that catarrh, degenerating into a chronic state after subsisting for many years, has of itself often proved fatal without inducing phthisis.

4. If phthisis does not frequently follow catarrh, it is still more rarely a consequence of asthma. Innumerable examples are unquestionably afforded of that disease subsisting for many years without any symptom whatever of phthisis as a consequence of it. But at the same time, there are unquestionable examples of phthisis deriving its origin from asthma; which, however, probably happens only in cases where a peculiar state of the lungs at the same time takes place: But without the concurrence of asthma, this state would not of itself have been sufficient for inducing the affection.

5. Of all the causes formerly mentioned, phthisis most frequently arises from tubercles. Dr Simmons informs us, that he has had opportunities of inspecting the bodies of many people who died in this way, and never found them totally absent. He has likewise seen them in subjects of different ages, who had been troubled with no symptoms of an affection of the breast during their lifetime. In these, however, they were small, and few in number. This proves that they may exist without inconvenience till they begin to disturb the functions of the lungs by their size and number; or till some degree of inflammation be excited, either by accidental causes, or by certain changes that take place within their substance; for as yet we know but little of their true nature. These little tumors vary in their consistence; in some they are composed of a pulpy substance, and in others approach more to the nature of scirrhous. They are most commonly formed in consequence of a certain constitutional predisposition; but whatever is capable of occasioning a morbid irritability of the lungs seems also to be capable of generating them. Thus the spasmodic asthma frequently ends in tubercles and consumption; and it is not unusual for millers, stone-cutters, and others, to die consumptive, from their being so constantly exposed to dust, which in these cases probably acts by producing similar concretions: and Dr Kirkland observes, that scythe-grinders are subject to a disease of the lungs, from particles of sand mixing with iron-dust, which among themselves they call the *grinders rot*. Turbercles, however, in by much the greater number of instances, have their source from a scrophulous disposition; and some eminent physicians have supposed that the generality of pulmonary consumptions are of this kind. This notion, however, they have perhaps carried too far: they have probably been misled by these tuberculous concretions which, without good reason, have been supposed to be diseased glands, and of course analogous to the glandular affections we meet with in the scrophula. Tubercles may likewise sometimes be owing to the sudden repulsion of cutaneous eruptions, or of the matter of exanthemata, &c. or to other causes.

Phthisis.

The persons who are most liable to consumption are those of a fair complexion, fine and soft skin, florid cheeks, and a slender make; with high cheek-bones, hollow temples, long neck, shoulders standing out like wings, narrow chest, and a remarkable prominence of the processes of the os sacrum. To these marks we may add, that of *sound teeth*, which, as the disease advances, usually become of a milky white colour, and more or less transparent. Of those who are carried off by this disease, Dr Simmons asserts, the greater number will be found never to have had a carious tooth. This circumstance, however, does not seem to us to hold so generally as Dr Simmons is disposed to imagine: and instances not unfrequently occur of patients dying of phthisis, although they have had many teeth subjected to caries; and some of these beginning even at an early period of life.

Persons of the above description often remain for a long time without feeling any other inconvenience than some oppression at the breast in moist weather, or in hot apartments. Their breathing is easily hurried, sometimes by the slightest motion; and they become languid, paler, and thinner. All this time, however, they feel no heat or painful sensation in the breast. As the evil increases, the patient begins to be attacked with a slight, frequent, and dry cough, which is most troublesome in the night-time. But this, by proper care, is often relieved; and the patient remains in this state for a considerable time, and even for many years, if he be sensible of his danger, and careful to guard against it by a suitable manner of living. More commonly, however, we find the cough increasing, and sometimes accompanied with more or less catarrh. This is usually ascribed to cold; and but too generally neglected, till the disease become alarming by its obstinacy and its effects. This may be considered as the *beginning*, or first period, of the disease. During this stage, the cough is sometimes dry from the first; and sometimes, when it begins in the form of a catarrh, is attended with more or less expectoration of mucus.

When the cough begins in the form of a catarrh, and appears to be occasioned by an increased secretion of a thin saltish mucus irritating the membrane of the trachea, all judicious practitioners agree in recommending an attention to regimen, the free use of diluting liquors, bland emulsions, small doses of nitre, the taking away a few ounces of blood if there be much in

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inflammation, the inhaling the ſteams of warm water by means of the machine contrived for that purpoſe, and occaſional uſe of ſuch a doſe of elixir paregoricum as, will be ſufficient to allay the irritation of the bronchiæ, and to promote a gentle moiſture on the ſkin. Theſe methods will generally be found to be efficacious, eſpecially if the patient's chamber be of a moderate temperature, and he carefully avoid expoſure to a cold, damp, or raw air, till the complaint be removed. In caſes in which the cough has been obſtinate, and the inflammatory ſymptoms conſiderable, Dr Simmons has often experienced the great advantages of the warm bath, the heat of which did not exceed 92. When this is had recourſe to, the patient ſhould remain in it only a very few minutes, and go ſoon afterwards to bed; but not with a view to force ſweat by an increaſed weight of bed-clothes, as is too often injudiciouſly practiſed.

Patients of a conſumptive habit, who have had an attack of this kind at the beginning of winter, are particularly liable to a return of the complaint during the continuance of the cold ſeaſon, on the ſlighteſt occaſion and with greater violence. A relapſe is therefore to be carefully guarded againſt; and nothing will be found to do this more effectually than the uſe of ſocks and a flannel under-waiſtcoat. The uſe of flannel has been condemned by ſeveral medical writers as increaſing the inſenſible perſpiration; but in the preſent caſe, to ſay nothing of ſome others in which it may be uſeful, it will in general be found to have the beſt effects. It will prevent a too great determination to the lungs, and ſhould not be left off till the approach of ſummer. In ſome few inſtances in which flannel was found to have a diſagreeable effect, a piece of dimity, worn over the breaſt next the ſkin, prevented the return of colds and coughs in perſons of a delicate habit, who had before been liable to them on the ſlighteſt occaſions, Shirts made of cotton cloth are much more effectual than linen in preſerving an equable temperature of the ſurface, and guarding againſt the action of external cold; while at the ſame time they are much more pleaſant to moſt people than even the fineſt flannel. In theſe caſes, circumſtances that are ſeemingly of the moſt trifling nature become of importance.

Sometimes the cough is occaſioned by an immediate inflammation of ſome part of the lungs, from ſome of the uſual cauſes of inflammation; and when this happens no time is to be loſt in removing it. To do this will perhaps require more than one bleeding, together with a ſtrict attention to a cooling plan of diet diluting drinks, the inhalation of warm ſteams, and if convenient the uſe of the warm bath: but above all, the ſpeedy application of a large bliſter as near as may be to the ſuppoſed ſeat of the inflammation. The cough, in this caſe, will often remain after the original complaint is abated. A prudent uſe of opiates at bed-time, either by themſelves or combined with gummy and mucilaginous medicines, will then generally be uſed as a ſedative and antiſpaſmodic.

In this, as well as in the catarrhal cough juſt now mentioned, many practitioners are too eager to adminiſter the Peruvian bark, with the view, as they term it, of *bracing up* the patient: but this never fails to increaſe the cough, and of courſe to do great and very often irreparable miſchief.

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And here it will not be foreign to our ſubject to obſerve, that a ſymptomatic cough, which has its riſe not from catarrh or from an immediate inflammation of the lungs, but from their ſympathy with the ſtomach, has ſometimes laid the foundation of phthiſis, from its having been miſtaken, and of courſe improperly treated. It ſeems to be owing to a redundancy or vitiated ſtate of the bile or to ſome affection of the ſtomach, which it is perhaps not eaſy to define. It is ſometimes a concomitant of other bilious ſymptoms; and when this happens to be the caſe, it cannot eaſily be miſtaken; but we ſometimes find it occuring ſingly, and in general attacking perſons of a ſedentary life. Dr Stoll of Vienna, who has noticed this cough has very properly given it the name of *tuſſis ſtomachica*. This complaint is ſo far from being relieved by bleeding that it conſtantly grows worſe after it, eſpecially if the evacuation be in any conſiderable quantity. The oily remedies ſeldom fail to exaſperate this cough, which at firſt is dry, frequent, and often extremely violent, but which ſeldom fails to give way to one or two gentle pukes, and the occaſional uſe of mild cathartics. The cough, as in other caſes, often continues from habit after the cauſe that gave riſe to it has been removed, and may then be checked by opiates.

When the diſeaſe has been neglected, or our attempts to remove it in the beginning have failed, both of which circumſtances but too frequently happen, the patient begins to complain of a ſoreneſs, and of ſlight lancinating pains ſhooting through the breaſt ſometimes in the direction of the mediaſtinum, and ſometimes confined chiefly to one ſide. The ſoreneſs is pretty conſtant, and much increaſed by the cough. The pain in the ſide often prevents the patient from lying on the ſide affected; and this inability of lying except on one ſide, frequently occurs even when no ſuch pain is felt. In this ſtage of the diſeaſe, flushing heats are felt in the palms of the hands and ſoles of the feet: the breathing is ſhort and laborious; and it is not long before the patient begins to expectorate a thin and frothy phlegm, at firſt in ſmall quantities coughed up with difficulty, and ſome pain of the breaſt and now and then ſtreaked with blood: this may be conſidered as the *inflammatory period* of the diſeaſe, to which ſucceeds the *ſuppurative ſtage*. In the latter, the expectoration becomes more copious and purulent, the breath proportionably offenſive, and the exacerbations of the hectic fever more conſiderable: an increaſed quickneſs of the pulſe comes on about the middle of the day; but the moſt conſiderable paroxyſm of the fever is at night, and at firſt continues till towards morning, commonly till three or four o'clock, when it terminates in a ſweat, which uſually begins upon the breaſt. As the diſeaſe advances, theſe ſweats become more profuſe, and ſome times come on almoſt as ſoon as the pulſe begins to quicken, but without affording any relief to the patient. During the exacerbations, we obſerve a circumſcribed redneſs of the cheeks, while the reſt of the face is pale, and appears as if it were not clean waſhed. The coſtiveneſs that commonly accompanies the beginning of the diſeaſe is uſually ſucceeded by a diarrhœa; the ſpitting leſſens and

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and all the purulent matter seems to be carried downwards. The wasting of the fat, and the loss of nourishment occasion the nails to curve inwards, the hair to fall off, and the eyes to sink in their sockets. In the mean time, the legs commonly swell; till at length death closes a scene which is melancholy to all but the patient himself, who in general continues sensible to the last moment, and even then indulges a vain hope of prolonging a miserable existence. In some cases, and that not unfrequently, a delirium comes on towards the close of the disease.

The hectic fever that attends this and some other chronic diseases is evidently the effect of acrimony, and most commonly of pus absorbed and carried into the circulation. The nature of this acrimony, and the different irritability of different patients, are probably the sources of the variety we observe in fevers of this denomination; a variety which is doubtless much greater than we are aware of. Thus we find that the matter of the small-pox excites a fever of this kind; but this *secondary fever*, as it is called, differs from the hectic attendant on consumptions; nor does the latter correspond with that which sometimes accompanies the suppuration of a cancerous ulcer. In the pulmonary consumption, or at least in the third stage of it, the fever induced often appears to be of the putrid kind, and has been denominated *febris hectica putrida* by the judicious Morton, who considers it as being combined with a peripneumonic or inflammatory fever, which recurs as often as fresh tubercles begin to inflame. For although we have named one period of the disease the *inflammatory*, and another the *suppurative period*, yet we are not to suppose that the latter is exempt from inflammation. While matter is poured into the bronchiæ, or absorbed and carried into the system from one part of the lungs, other parts are in a crude state of inflammation, or advancing towards suppuration: so that, on examining the lungs of persons who die consumptive, we find some tubercles that are small and just formed, some that are large and full of matter, and others that are in a state of ulceration. This easily accounts for the occasional combination of inflammatory symptoms with those of the putrid hectic. When the matter absorbed is a laudable pus, as in the case of a psoas abscess, we find the form of the hectic fever differing from either of those we have mentioned.

Cure. In these different periods of the disease, the curative indications are sufficiently obvious. To prevent the formation of fresh tubercles; to obviate the inflammation of those already formed; to promote their resolution; to allay morbid irritability, the cough, and other troublesome symptoms; and, above all, to check the tendency to the hectic state, are the views that every rational physician proposes to himself in the treatment of the genuine consumption. We know of no medicines that can exert their specific effects upon the lungs by dissolving tuberculous concretions; nor is it probable, from what we know of the animal œconomy, that any such will ever be discovered. Yet medicines that operate in a general manner upon the system, may, by promoting absorption, and diminishing the determination to the lungs, tend to disperse tubercles, or to prevent their formation. There are not wanting instances of wonderful recoveries in cases where the evil was supposed to be beyond the power of physic; and in some, where nature was left to herself; so that a physician who has observed the various and powerful resources nature has within herself, will be very cautious how he asserts that a disease is incurable.

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The most formi able effects of ulcerated lungs are the absorption and consequent hectic. It seems evident, that, in many cases, death is brought on by this, rather than by the lungs themselves being rendered unfit for the purposes of respiration. So that if we can obviate the effects of the absorption, diminish the preternatural determination to the lungs, and fulfil the other general indications just now mentioned, we may very often enable nature to recover herself. It may be alleged indeed, that the physician's art has hitherto proved very unsuccessful in these cases; but may not this be owing to the remedies that are employed being very often such as are inimical to the cure;

The Peruvian bark is, perhaps, the most commonly employed of any, and often confided in as an ultimate resource in these cases. But besides this, the elixir of vitriol, the balsams, and frequent bleedings, have each had their partizans. The use of blisters and issues, opiates, a milk and vegetable diet, exercise, and change of air, are pretty generally recommended by all. Concerning the bark, Default long ago observed, that it had been productive of great mischief in consumptive cases; and Dr Fothergill, in a paper lately published by him on this subject, very judiciously remarks, that the bark is so far from curing the hectic fever arising from distempered lungs, that according to the best of his observations, it not only takes up that time which might probably have been better employed in the use of other medicines, but for the most part aggravates the disease beyond remedy. Indeed it has been the opinion of several attentive observers, that, whenever pus or or any kind of matter excites an hectic fever, by being absorbed and carried into the circulation, the Peruvian bark will never fail to exasperate the complaint, especially if it be accompanied with any degree of inflammatory diathesis, unless the matter has a free outlet from the system; as in the case of abscesses, for instance, in which we often find the bark productive of excellent effects. It is likewise well known to be used as a tonic, to obviate the effects of fluor albus, or any other immoderate evacuation in delicate persons, which, by enfeebling the system, very often lays the foundation of phthisis: but the moment we have reason to suspect that the lungs are ulcerated, especially if this ulceration be atttended with an inflammatory disposition; or if the separation of vitiated pus be the consequence of a peculiar increased morbid action of the vessels at the part, it ought to be laid aside; and in the genuine tuberculous consumption, perhaps it is at all times inadmissible.

Dr Fothergill, however, observes, that there are two causes of consumptions, which often produce symptoms o similar to those of the genuine phthisis, as sometimes to have led him to make use of the bark in apparent tendencies to a genuine pulmonary consumption with advantage.

One of these causes is, the suckling of children longer than is consistent with the mother's ability. This

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This case frequently occurs among the middling and lower classes of females of constitutions naturally delicate and tender. In such a state of weakness, some slight cold brings on a cough, which increases gradually, till at length it produces the true pulmonary consumption. Here the bark given early, in moderate doses, and merely as a tonic remedy, is often of excellent use.

Another cause is, any weakening discharge, either from abscesses, the greater operations of surgery, a copious and constant *flour albus*, or similar enfeebling evacuations. That the bark is, for the most part, of use in these cases, when the lungs are not inflamed, is indubitable; and if they be so affected, but not beyond a certain degree, it is also efficacious in preventing the progress of the consumption.

In phthisical complaints succeeding such situations, a prudent trial of the bark seems necessary. Small doses of the decoction, either alone, or joined with the saline mixture or such other additions as the physician thinks proper, may be given. But if the breath becomes more tight and oppressed, the cough dry, the pulse more quick and hard, and especially if slight transitory pains or stitches about the thorax are more frequently complained of, a perseverance in the use of the bark will increase the disease. If such also should be the appearances in the progress of the disease, or, from whatever cause, if the bark be accompanied with such effects, the use of it ought to be with-held.

If, on the other hand, no pain, tightness, or oppression is perceived, and there appears a manifest abatement of the symptoms, it will be advisable to proceed. The administration of this medicine, however, requires a judicious observer; and it ought neither to be given in the early inflammatory stage of this disease, nor be continued in any subsequent period, if it produce the effects abovementioned.

By its tonic virtues it will often enable nature to conquer many difficulties. In confirmation of this remark, Dr Fothergill farther observes, that he has seen it of use in promoting expectoration, when this became deficient from want of strength towards the end of peripneumonic fevers; but that it stops this discharge, changes slight wandering pains into such as are fixed, and increases them with all their consequences, in a variety of cases.

The elixir of vitriol, or the pure vitriolic acid properly diluted, though in many instances a highly useful remedy, is often exhibited in consumptive cases with no less impropriety than the bark. This medicine, from its astringency, is obviously improper in the inflammatory state of the disease. But in the latter stage, when a general tendency to putrefaction takes place, it is serviceable in resisting the effect; it restrains the colliquative sweats; and if the lungs be not injured past reparation, it is allowed to be a very useful auxiliary.

Various are the opinions concerning the efficacy of Bristol-water in this disease. The experienced author last mentioned informs us, that he has seen many persons recover from pulmonary diseases after drinking these waters, whose cure seemed to be doubtful from any other process; and he thinks this circumstance, added to the general reputation of Bristol-waters in phthisical cases, affords sufficient inducement to recommend the trial of them in the early stages of such complaints. It is, however, before the approach of a confirmed phthisis that patients ought to repair to Bristol; otherwise a journey thither will not only be without benefit, but may even prove detrimental.

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Some have imagined, that the journey, a better air, change of situation and of objects, have contributed to the patient's recovery; and these may doubtless be of advantage. It seems, however, that the water drank fresh at the pump, actually contains principles conducive to the recovery of patients affected with phthisical complaints. It seems to possess a slight calcareous stypticity, and perhaps the air it contains may also have an antiseptic quality. On the whole, it appears to be an efficacious medicine, and is often found of remarkable benefit to consumptive patients.

Change of air, particularly from good to bad, is of great consequence in all chronic diseases of the lungs. In consumptive cases, the air of all large cities is found to be particularly injurious.

A sea-voyage has been much recommended in the cure of this disease. The benefit of exercise has also been strongly urged by many writers; but, however salutary when properly used, it certainly ought to be regulated with discretion. Dr Dickson declares himself of opinion, that riding on horseback in consumptive cases is most commonly hurtful, without such regulations as in general have been little regarded. For instance, he has known a person who, by a ride of an hour or two in the morning, was very much recruited, and who, at another time, in the afternoon and evening, without undergoing more bodily motion, has returned faint and languid, and apparently worse. This observation on the same person has been so frequently made, as to point out clearly the times when this exercise shall not do hurt in consumptive cases. In this disease, the pulse, however calm in the morning, becomes more frequent in the afternoon and night, attended with heat and other feverish symptoms. Exercise therefore, at this time, can only add to the mischief of the fever. For this reason he prudently recommends to all hectic persons, especially those who shall travel to distant places on account of a better air, or the benefit expected from any particular water, that their travelling should be slow, confined to a very few hours, and only in the morning.

Exercise on horse-back seems to be chiefly beneficial in those cases where consumption is a secondary disease. For example, in the nervous atrophy; in the hypochondriacal consumption; or when it is the effect of long continued intermittents, or of congestions in any of the abdominal viscera; or, in a word, whenever the consumption is not attended with an inflamed or ulcerated state of the lungs; long journeys on horseback will be beneficial. Such a practice may likewise be highly useful in obviating an attack of phthisis, or in carrying off a dry husky cough in a person of a consumptive habit, when there is reason to suppose that no tubercles are as yet formed. On the other hand, in the confirmed phthisis, when the lungs are inflamed or ulcerated, much or violent exercise will be improper; and there have been instances where the death of the patient was evidently accelerated by it.

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it. The exercise therefore should be gentle, proportioned to the strength of the patient, and employed only in the morning. In fine weather, an easy open carriage is perhaps the most eligible, not only on account of its being open to the air, but because it affords that kind of agitation which is most wanted in these cases. For if we consider the different modes of exercise, we shall find that walking, though the best exercise in health, as it employs the most muscles, is the worst for the sickly, who should have the benefit of exercise without fatigue. Riding on horseback agitates the viscera more than walking, and is therefore preferable to it in many chronic diseases; but when a preternatural determination to the lungs has taken place; it will be liable to increase the evil, and may likewise be hurtful by the fatigue that attends it. For these reasons it will be prudent to begin with a carriage; and if the patient gain stregth, and the disease abates, recourse may afterwards be had to horse-exercise.

The gentle motion of a coach has been often found of great utility in pulmonary complaints. Its efficacy seems to depend chiefly on its increasing the determination to the surface of the body. The nausea which this motion excites in some persons is an effect of this increased determination. It has therefore been found beneficial in hæmoptysis; and Dr Simmons mentions the case of a lady, who, after trying various remedies to no purpose, was cured of this complaint by travelling several hundred miles through different parts of England in her own coach. At first, whenever she tarried three or four days in any place, the disorder began to return again; but at length by persevering in her journeys, it gradually went off. Default, who practised at Bourdeaux about 40 years ago, tells us, he sent several consumptive patients to Bareges, and with good success; but that in these cases his reliance was not so much upon the Bareges waters, as upon the motion of the carriage and the change of air in a journey of more than 100 leagues.

It is now pretty generally acknowledged, that the good effects of sea-voyages in consumptive cases depend more upon the constant and uniform motion of the ship, than upon any particular impregnation of the sea-air; although this from its coolness and purity may likewise be of great use, especially in the hot months, when sea-voyages are generally undertaken by consumptive patients. The ancients were no strangers to this remedy; and amongst the Romans it was no unusual thing for consumptive persons to sail to Egypt. Pliny observes, that this was done not for the sake of the climate, but merely on account of the length of the voyage.

Many of the English physicians have recommended a voyage to Lisbon in these cases. When this is done, the proper season of the year should be carefully attended to. Dr Simmons knew a gentleman who went thither with symptoms of incipient phthisis, and who experienced some relief during the course of the voyage; but happening to arrive at Lisbon at the beginning of the rainy season, the disease was soon greatly increased, and terminated fatally.

Another species of motion has of late been extolled as highly useful in consumptive cases. Dr James Carmichael Smyth of London, has lately published an account of the effects of swinging, employed as a remedy in the pulmonary consumption and hectic fever. In this treatise Dr Smyth contends, that sea-air, in place of being of advantage is constantly prejudicial to hectic and consumptive patients, and even to those who have a tendency to such complaints. He thinks, therefore, that the benefit derived from sea-voyages must certainly be referred to some other cause. In stating his sentiments on this subject, he attempts to establish a distinction between exercise and motion. By exercise, he understands muscular action, or the exertion of the loco-motive powers of the body either alone or combined. This he represents as increasing the force and frequency of the heart's contraction, the velocity and momentum of the blood, the quickness of breathing, the heat, the irritability, and the transpiration of the whole body. By motion, in contradistinction to exercise, he means such motion as is not necessarily accompanied with any agitation or succussion of the body, and which is totally independent of any muscular exertion. The effects of this, both on the heart, the lungs, and indeed on the system in general, he considers as of the sedative kind; thus it suspends the action of coughing, and lessens the frequency of the pulse. He is, therefore, led to refer the good effects of sea-voyages entirely to this cause. And on these grounds he was led to conclude, that the motion given by swinging might be of equal if not greater service, This conclusion, we are told, in the treatise above alluded to, experience in many cases has fully confirmed. And he recommends it as a mode of cure which may be employed with advantage in every stage of phthisis. While, however, the reasoning of Dr Smith on this subject seems to be liable to many objections, we are sorry to add, that his observations in practice have by no means been confirmed by those of others, who have had recourse to this mode of cure.

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The best adapted diet in consumptive cases is milk, particularly that of asses. It may however be remarked, that there are constitutions in which this salutary nutriment seems to disagree. A propensity to generate bile, or too strong a disposition to ascency from a weakness of the digestive organs, both merit attention. Whey, either from cows or goat's milk, appears to be more suitable in the former case; and for correcting acidity, lime-water may be added to the milk. The method of adding rum or brandy to asses or cows milk, should be used with great caution; for when added beyond a certain quantity, as is often the case, they not only coagulate the milk, but heat the body; by which means the former disagrees with the patient, and the spirit augments the disease.

In consumptive cases, Dr Simmons observes, that the patient's taste should be consulted; and says that a moderate use of animal food, where the salted and high-seasoned kinds are avoided, is not to be denied. Shell-fish, particularly oysters, are useful as well as snails swallowed whole, or boiled in milk.

Repeated bleedings, in small quantities, are considered in consumptive cases as highly advantageous: and in particular circumstances they undoubtedly are so; for instance, when the constitution apparently abounds with blood; when the fluid drawn off is extremely sizy; when there is much pain in the breast; and

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and when venesection is followed by an abatement of every symptom. In these cases, bleeding is certainly proper, and ought to be repeated so long as it seems to be attended with advantage. In very delicate constitutions, however, even where the pulse is quick, with some degree of fulness, and the blood last drawn considerably sizy, it may not prove equally serviceable.

It deserves to be remarked, that the inflammatory appearance of the blood is not alone a sufficient reason for bleeding; but, in determining the propriety of this evacuation, all other circumstances should be considered; such as the patient's age, strength, habit, and the state of the disease.

A remark which has been judiciously made by Dr Fothergill, ought not to be omitted in the account of this disease. It is, that young delicate females, from the age of 15 or 16, and upwards, are often subject to consumptions. When the disease has advanced considerably, the *menses*, if they have made their appearance, most generally cease. This alarms their female friends, and they call upon the physician to use his utmost endeavours for restoring the discharge; believing the cessation of it to be the immediate cause of the phthisical complaint. Induced by their solicitations, medicines have sometimes been administered, which, without obtaining this end, have tended to aggravate the distemper. This deficiency is often of no real disadvantage in those cases; and in many the evacuation would prove injurious, by diminishing the strength, which is already too much impaired. Even small bleedings at the regular periods have often done more harm than good. A sudden suppression may require bleeding: but when the evacuation fails through want of strength, and from poverty of blood, the renewal of it increases the disease.

Besides these remedies, Dr Simmons strongly recommends a frequent repetition of vomits. Many physicians have supposed, that where there is any increased determination to the lungs, vomits do mischief; but Dr Simmons is persuaded, that instead of augmenting they diminish this determinatian; and that much good may be expected from a prudent use of this remedy, than which none has a more general or powerful effect on the system. If any remedy be capable of dispersing a tubercle, he believes it to be vomits. The affections of the liver, that sometimes accompany pulmonary complaints, give way to repeated emetics sooner than to any other remedy. In several cases where the cough and the matter expectorated, the flushing heats, loss of appetite, and other symptoms, threatened the most fatal event; the complaints were greatly relieved, and in others wholly removed, by the frequent use of emetics. Other suitable remedies were indeed employed at the same time; but the relief the patients generally experienced after the emetic, was a sufficient proof of its salutary operation. By this, however, he does not mean that vomits will be useful in every period of the disease, or in every patient. In general, it will be found that the earlier in the disease emetics are had recourse to, the more likely they will be to do good and the less likely to do harm. The cases in which emetics may be reckoned improper, are commonly those in which the disease is rapid in its progress; or in that stage of it when there is great debility, with profuse colliquative sweats.

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In these cases, when an emetic has been administered twice a-week, and the cough is mitigated, the expectoration facilitated, and the other symptoms relieved, both the patient and the physician will be encouraged to proceed, and to repeat the vomit every second day, or even every day, for several days together, as Dr Simmons has sometimes done when the good effects of it were obvious.

The choice of emetics to be employed in these cases is by no means a matter of indifference. Carduus tea, camomile tea, warm water, and others that act by their bulk, and by exciting nausea, relax the tone of the stomach when they are frequently repeated, and of course will be improper. More active emetics are therefore to be preferred; and here some of the preparations of antimony might naturally be thought of. But the operation of these is not confined to the stomach. They produce evacuations by stool, and a disposition to sweat; and are therefore improper in the pulmonary hectic. The mildness and excellence of ipecacuanha as an emetic, are well known; but in these cases, Dr Simmons has often employed the blue vitriol, concerning the effects of which we meet with some groundless assertions in several medical books. Its operation is confined to the stomach; it acts almost instantaneously, and its astringency seems to obviate the relaxation that is commonly supposed to attend the frequent use of emetics. In two cases he experienced its good effects, after vomits of ipecacuanha had been given ineffectually. It should be administered in the morning, and in the following manner:

Let the patient first swallow about half a pint of water, and immediately afterwards the vitriol dissolved in a cupful of water. The dose of it must be adapted to the age and other circumstances of the patient, and may be varied from two grains to ten, fifteen or twenty. As some persons are much more easily puked than others, it will be prudent to begin with a small dose: not that any dangerous effects will be produced by a large one, for the whole of the medicine is instantly rejected; but if the nausea be violent, and of long continuance, the patient may perhaps be discouraged from repeating it. In general, the moment the emetic has reached the stomach it is thrown up again. The patient must then swallow another half pint of water, which is likewise speedily rejected; and this is commonly sufficient to remove the nausea.

Dr Marryat, in his *New Practice of Physic*, prescribes with great freedom what he calls the *dry vomit*, from its being directed to be taken without drinking. This medicine consists of blue vitriol and the emetic tartar; but its good effects have not yet been ascertained by other practitioners.

Another remedy which Dr Simmons strongly recommends in consumptive cases, both from his own observation and on the authority also of many other eminent practitioners is gum myrrh. This given by itself to the extent of a scruple or half a dram for a dose, two or three times a-day, or, if there be much inflammatory tendency, combined with a proportion of nitre or of cream of tartar, has often been service-

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able in cases which were apparently instances of incipient phthisis even of the tuberculous kind. But when the disease is far advanced, or even decidedly marked, as far as our experience goes it has rarely if ever been productive of any benefit.

Besides the use of internal remedies in pulmonary affections, physicians have often prescribed the steams of resinous and balsamic substances to be conveyed into the lungs. The vapour of dulcified spirit of vitriol, dropt into warm water, has likewise been used in these cases, and is advertised as a nostrum under the name of *æther*. The inhaling of fixed air has also been spoken of as an useful practice. Dr Simmons has seen all of these methods tried at different times; but without being able to perceive any real advantages from them in the suppurative stage of the disease, where they might be expected to be of the greatest use; and in the beginning he has often found the two first to be too stimulating. He therefore preferred the simple vapour of warm water, and has experienced its excellent effects in several instances; but when the complaint has made any considerable progress, its utility is less obvious; and when the patients have been much weakened, he has seen it bring on profuse sweats, especially when used in bed, and therefore generally recommended it to be used in the day-time. Formerly he made use of a fumigating machine, described in the Gentleman's Magazine for 1748, in which the air, inspired by the patient, is made to pass through hot water by means of a tube that communicates with the external air, and with the bottom of the vessel: but we have now a more elegant and (on account of the valve and mouth-piece) a more useful instrument of this kind, the inhaler, invented by the ingenious Dr Mudge.

Another remedy recommended by some as a specific in consumptions is the earth-bath. Van Swieten, in his Commentaries on Boerhaave, tells us, from the information of a person of credit, that in some parts of Spain they have a method of curing the phthisis pulmonalis by the use of this remedy; and he quotes the celebrated Solano de Luque in confirmation of this practice. Solano speaks of the *banos de tierra*, or earth-baths, as a very old and common remedy in Granada and some parts of Andalusia, in cases of hectic fever and consumptions; and relates several instances of their good effects in his own practice. The method he adopted on these occasions was as follows: He chose a spot of ground on which no plants had been sown, and there he made a hole large and deep enough to admit the patient up to the chin. The interstices of the pit were then carefully filled up with the fresh mould, so that the earth might every where come in contact with the patient's body. In this situation the patient was suffered to remain till he began to shiver or felt himself uneasy; and during the whole process, Solano occasionally administered food or some cordial medicine. The patient was then taken out, and, after being wrapped in a linen cloth, was placed upon a matrass, and two hours afterwards his whole body was rubbed with an ointment, composed of the leaves of the *solanum nigrum* and hog's lard. He observes, that a new pit must be made every time the operation is repeated; and advises the use of these baths only from the end of May to the end of October. Dr Fouquet, an ingenious French physician, has tried this remedy in two cases. In one, a confirmed phthisis, he was unsuccessful; but the remedy had not a fair trial. The patient, a man 30 years of age, had been for several months afflicted with cough, hectic fever, and profuse colliquative sweats. He was first put into the earth in the month of June; but soon complained of an uneasy oppression at his stomach, and was removed at the end of seven minutes. The second time he was able to remain in it half an hour, and when taken out was treated in the way prescribed by Solano. In this manner the baths were repeated five times, and the patient was evidently relieved; but having conceived a dislike to the process, he refused to submit to any further trials, and died some months afterwards. In the second case he was more fortunate: the patient, a girl 11 years of age, had been for three months troubled with a cough brought on by the measles, which was at length attended with a purulent expectoration, hectic fever, and night-sweats. She began the use of the earth-bath in August, and repeated it eight times in the space of 20 days. At the end of that time the fever and disposition to sweat had entirely ceased, and by the use of the common remedies the patient was perfectly restored. A physician at Warsaw has likewise prescribed the earth-bath with good success in cases of hectic fever. The Spaniards confine it entirely to such cases; but in some other parts of the world we find a similar method employed as a remedy for other diseases, and particularly for the sea-scurvy. Dr Priestley observes, that the Indians, he has been told, have a custom of burying their patients labouring under putrid diseases up to the chin in fresh mould, which is also known to take off the fœtor from flesh-meat beginning to putrify. The rancidity of a ham for example, may be corrected by burying it for a few hours in the earth. The efficacy of this remedy in the sea-scurvy has, it is said, frequently been experienced by the crews of East India ships.

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Solano, who is fond of philosophizing in his writings, is of opinion, that the earth applied in this way absorbs the morbid taint from the system: but does it not seem more probable, that the effluvia of the earth, by being absorbed and carried into the circulation, corrects the morbid state of the fluids, and thus are equally useful in the sea-scurvy and in the pulmonary hectic? That the earth when moistened does emit a grateful odour is a fact generally known; and Baglivi long ago gave his testimony in favour of the grateful effects of the effluvia of fresh earth. He ascribes these good effects to the nitre it contains.

The earth-bath, both in consumptive cases and likewise in a variety of other affections, has of late been extensively employed in Britain by a celebrated empiric. But, as far as we can learn, in most cases it produced to the patient a very distressing sensation of cold; in some, it seemed to be productive of bad effects, probably in consequence of this cold; and we have not heard of any consumptive cases in which good effects were decidedly obtained from it.

With regard to the drains, such as blisters, issues, and setons, that are so frequently recommended in pulmonary complaints, there is less danger of abuse from them than from the practice of venesection. The discharge they excite is not calculated to weaken the patient.

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tient much; and the relief they have so often been found to afford, is a sufficient reason for giving them a trial. Blisters, as is well known, act in a twofold manner; by obviating spasm, and producing revulsion: Issues and setons act chiefly in the latter of these two ways; and in this respect their effects, though less sudden and less powerful at first, are more durable from the continuance of the discharge they occasion. It is perhaps hardly necessary to remark, that, if much service is to be expected from either of these remedies, they should be applied early in the disease. The ingenious, Dr Mudge, who experienced the good effects of a large scapulary issue on his own person, very properly observes, that the discharge in these cases ought to be considerable enough to be felt. But it is seldom possible for us to prevail on the delicate persons, who are most frequently the victims of this disease, to submit to the application of a caustic between the shoulders. The discharge produced by a seton is by no means inconsiderable; and as in these cases there is generally some inflammatory stitch, some part of the breast that is more painful or more affected by a deep inspiration than the rest, a seton in the side, as near as can be to the seat of the inflammation, will be an useful auxiliary. Dr Simmons has seen it evidently of great use in several cases.

Genus XXXVIII. HÆMORRHOIS.

240 Hemorrhoids, or Piles.

Hæmorrhois, *Sauv.* gen. 217. *Lin.* 192. *Sag.* gen. 182.
Hæmorrhoidalis fluxus. *Hoffm.* 219.
Hæmorrhoides, *Junck.* 11. and 12.
Leucorrhois, *Vog.* 112.

Sp. I. *External Piles.*

241 Var. A. *Bloody Piles.*

Hæmorrhois moderata, *Sauv.* sp. 1.
Hæmorrhoides ordinatæ, *Junck.* 11.
Hæmorrhoides nimiæ, *Junck.* 11.
Hæmorrhois immodica, *Sauv.* sp. 2.
Hæmorrhoides excedentes, *Alberti.* de hæmorrhoid. p. 179.
Hæmorrhois polyposa. *Sauv.* sp. 3.

Var. B. *Mucous Piles.*

Hæmorrhoides decoloratæ, albæ, et mucidæ, *Junck.* 13. *Alberti*, p. 248.

242 SP. II. The *Piles* from a *Procidentia Ani.*

Hæmorrhois ab exania, *Sauv.* sp. 4.

243 SP. III. The *Running Piles.*

244 SP. IV. The *Blind Piles.*

Hæmorrhoides cœcæ, *Junck.* 12. *Alberti*, p 274

Description. The discharge of blood from small tumors on the verge of the anus constitutes what is called the *hæmorrhoides* or *piles.* They are distinguished into the *external* and *internal*, according to the situation of the tumors, either without or within the anus. Sometimes, however, these tumors appear without discharging any blood; and in this case they are called the *hæmorrhoides cæcæ* or *blind piles.* Sometimes the disease appears without the verge of the anus in distinct separate tumors; but frequently only one tumid ring appears, seeming as it were the anus pushed without the body. Sometimes these tumors appear without any previous disorder of the body: but more frequently, before the tumors are formed and sometimes even before the blood begins to flow, various affections are perceived in different parts of the body; as head-ach, vertigo, stupor, difficulty of breathing, sickness, colic pains, pain of the back and loins, and frequently a considerable degree of pyrexia; while along with these symptoms there is a sense of fullness, heat, itching, and pain, in and about the anus. Sometimes the disease is preceded by a serous discharge from the anus; and sometimes this serous discharge, accompanied with swelling, seems to come in place of the discharge of blood, and to relieve the abovementioned disorders of the system. This serous discharge hath therefore been named the *hæmorrhois alba.*

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In this disease the quantity of blood discharged is different upon different occasions. Sometimes it flows only when the person goes to stool, and commonly follows the discharge of fæces. In other cases it flows without any discharge of fæces; and then generally in consequence of the disorders abovementioned, when it is also commonly in larger quantity. This is often very considerable; and, by the repetition, so great, that we could hardly suppose the body to bear it but with the hazard of life. Indeed, though rarely, it has been so great as to prove suddenly fatal. These considerable discharges occur especially to persons who have been frequently liable to the disease. They often induce great debility, and frequently a leucophlegmatia or dropsy which proves fatal. Sometimes the tumors and discharges of blood in this disease recur exactly at stated periods. In the decline of life it frequently happens that the hæmorrhoidal flux, formerly frequent, ceases to flow; and in that case it generally happens that the persons are affected with apoplexy or palsy. Sometimes hæmorrhoidal tumors are affected with inflammation, which ends in suppuration, and gives occasion to the formation of fistulous ulcers in those parts.

The hæmorrhoidal tumors have often been considered as varices or dilatations of the veins; and in some cases varicous dilatations have appeared upon dissection. These, however, do not appear in the greater part of cases; and Dr Cullen is of opinion that they are usually formed by an effusion of blood into the cellular texture of the intestine near to its extremity. When recently formed, they contain fluid blood; but after they remain for some time they are usually of a firmer consistence, in consequence of the blood being coagulated.

Causes, &c. It would seem probable, that the hæmorrhoidal tumors are produced by some interruption of the free return of the blood from the rectum, by which a rupture of the extremities of the veins is occasioned. But considering that the hæmorrhagy occuring here is often preceded by pain, inflammation, and a febrile state, and with many other symptoms which show a connection of the topical affection with the state of the whole system, it is probable that the interruption of the blood in the veins

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produces a considerable resistance to the motion of the blood though the arteries, and consequently that the discharge of blood is commonly from the latter. Some have thought, that a difference of the hæmorrhois, and of its effects upon the system, might arise from the difference of the hæmorrhoidal vessels from whence the blood issued. But Dr Cullen is of opinion, that we can scarce ever distinguish the vessels from which the blood flows, and that the frequent inosculations of both arteries and veins belonging to the lower extremity of the rectum, will render the effects of the hæmorrhagy much the same, from whatever source it proceeds.

With regard to the hæmorrhoids, however, he is of opinion, that they are, for the most part, merely a topical affection. They take place before the period of life at which a venous plethora happens. They happen to females, in whom a venous plethora determined to the hæmorrhoidal vessels cannot be supposed to occur; and they happen to both sexes, and to persons of all ages, from causes which do not affect the system, and are manifestly suited to produce a topical affection only.

These causes are, in the first place, the frequent voiding of hard and bulky fæces, which, by their long stagnation in the rectum, and especially when voided, must necessarily press upon the veins of that part, and interrupt the course of the blood in them. For this reason the disease so frequently happens to those who are habitually costive. From the same causes, the disease happens frequently to those who are subject to a prolapsus ani. In voiding the fæces, it almost always happens that the internal coat of the rectum is more or less protruded; and, during this protrusion, it sometimes happens that the sphincter ani is contracted: in consequence of this, a strong constriction is made, which preventing the fallen-out gut from being replaced, and at the same time preventing the return of blood from it, occasions a considerable swelling, and the formation of a tumid ring round the anus.

Upon the sphincter's being a little relaxed, as it is immediately after its strong contraction, the portion of the gut which had fallen out is commonly taken into the body again; but by the frequent repetition of the accident, the size and fulness of the ring formed by the prolapsed intestine is much increased. It is therefore more slowly and difficultly replaced; and in this consists the chief uneasiness of hæmorrhoidal persons. As the internal edge of this ring is necessarily divided by clefts, the whole often puts on the appearance of a number of distinct swellings; and it also frequently happens, that some portions of it are more considerably swelled, become more protuberant, and form those small tumors more strictly called *hæmorrhoids* or *piles*.

From considering that the pressure of the fæces, and other causes interrupting the return of venous blood from the lower extremity of the rectum, may operate a good deal higher up than that extremity, we may understand how tumors may be formed within the anus; and probably it also happens, that some of the tumors formed without the anus may continue when taken within the body, and even be increased by the causes just mentioned. Thus may the production of internal piles be explained, which, on account of their situation and bulk, are not protruded on the person's going to stool, and are therefore more painful.

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The production of piles is particularly illustrated by this, that pregnant woman are frequently affected with the disease.—This is to be accounted for, partly from the pressure of the uterus upon the rectum, and partly from the costive habit to which pregnant women are liable. Dr Cullen has known many instances of piles happening for the first time during the state of pregnancy; and there are few women who have born children, that are afterwards entirely free from piles. —Purgatives also, especially those of the more acrid kind, and particularly aloetics, are apt to produce the piles when frequently used; and as they stimulate particularly the larger intestines, they may be justly reckoned among the exciting causes of this disease.

Prognosis. Though the hæmorrhoids are commonly, as we have said, to be esteemed a topical disease, they may, by frequent repetition, become habitual and connected with the state of the whole system; and this will more readily happen in persons who have been once affected with the disease, if they be frequently exposed to a renewal of the causes which occasioned it. It happens also to persons much exposed to a congestion in the hæmorrhoidal vessels, in consequence of their being often in an erect position of the body, and in an exercise which pushes the blood into the depending vessels, while at the same time the effects of these circumstances are much favoured by the abundance and laxity of the cellular texture about the anus. It is to be particularly observed, that when an hæmorrhoidal affection has either been originally or has become a disease of the system, it then acquires a particular connection with the stomach; so that certain affections of the stomach excite the hæmorrhoidal disease, and certain states of this disease excite the disorders of the stomach.

It has been an almost universally received opinion, that the hæmorrhoidal flux is a salutary evacuation, which prevents many diseases that would otherwise have happened; and that it even contributes to give long life: and as this opinion has been strenuously adopted by Dr Stahl, it has had a very considerable influence on the practice of physic in Germany. But Dr Cullen maintains that we can never expect to reap much benefit from this flux, which at first is purely topical; and, granting that it should become habitual, it is never, he thinks, proper to be encouraged. It is a disagreeable disease; ready to go to excess, and thereby to prove hurtful and sometimes, even fatal. At best it is liable to accidents, and thus to unhappy consequences. He is therefore of opinion, that even the first approaches of the disease are to be guarded against; and that, though it should have proceeded for some time, it ought always to be moderated, and the necessity of it superseded.

Cure. The general intentions of cure in cases of hæmorrhois are much varied, according to the circumstances of the affection at the time. When hæmorrhois exists in the state of tumor, the principal objects are to counteract inflammation, and to promote a discharge of blood from the part. When it is in the

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ſtate of evacuation, the chief intentions of cure are, to diminiſh the impetus of blood at the part affected, and to increaſe the reſiſtance to the paſſage of blood through the ruptured veſſels. And finally, when the diſeaſe exiſts in the ſtate of ſuppreſſion, the aims of the practitioner muſt chiefly be, to obviate the particular affections which are induced in conſequence of the ſuppreſſion; to reſtore the diſcharge, as a means of mitigating theſe and preventing others; or when the diſcharge cannot with propriety or advantage be reſtored, to compenſate the want of it by vicarious evacuations.

With theſe various intentions in different caſes, a variety of different remedies may be employed with advantage.

When any evident cauſe for this diſeaſe is perceived, we ought immediately to attempt a removal of that cauſe. One of the moſt frequent remote cauſes is an habitual coſtiveneſs; which muſt be obviated by a proper diet, ſuch as the perſon's own experience will beſt direct; or if the management of diet be not effectual, the belly muſt be kept open by medicines, which may prove gently laxative, without irritating the rectum. In moſt caſes it will be of advantage to acquire a habit with regard to the time of diſcharge, and to obſerve it exactly. Another cauſe of the hæmorrhois to be eſpecially attended to is the prolapſus ani, which is apt to happen on a perſon's having a ſtool. If this ſhall occur to any conſiderable degree, and be not at the ſame time eaſily and immediately replaced, it moſt certainly produces piles, or increaſes them when otherwiſe produced. Perſons therefore who are liable to this prolapſus, ſhould, after having been at ſtool, take great pains to have the inteſtine immediately replaced, by lying down in an horizontal poſture, and preſſing gently upon the anus, till the reduction ſhall be completely obtained. When this prolapſus is occaſioned only by the voiding of hard and bulky fæces, it is to be removed by obviating the coſtiveneſs which occaſions it. But in ſome perſons it is owing to a laxity of the rectum; and in thoſe it is often moſt conſiderable on occaſion of a looſe ſtool. In theſe caſes, it is to be treated by aſtringents, and proper artifices are to be employed to keep the gut in its place.

When the diſeaſe has frequently recurred from neglect, and is thus in ſome meaſure eſtabliſhed, the methods abovementioned are no leſs proper; but in this caſe ſome other meaſures muſt alſo be uſed. It is eſpecially proper to guard againſt a plethoric ſtate of the body; and therefore to avoid a ſedentary life, full diet, and intemperance in the uſe of ſtrong liquor, which in all caſes of hæmorrhagy is of the moſt pernicious conſequence.

Exerciſe of all kinds is of great ſervice in obviating and removing a plethoric ſtate of the body; but upon occaſion of the hæmorrhoidal flux, when this is immediately to come on, both walking and riding, as increaſing the determination of the blood into the hæmorrhoidal veſſels, are to be avoided. At other times, when no ſuch determination is already formed, theſe modes of exerciſe may be very properly employed.

Another method of removing plethora is by cold bathing; but this muſt be employed with caution. When the hæmorrhoidal flux is approaching, it may be dangerous to divert it; but during the intervals of the diſeaſe cold bathing may be employed with ſafety and advantage; and in thoſe who are liable to a prolapſus ani, the frequent waſhing of the anus with cold-water may be uſeful.

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Beſides general antiphlogiſtic regimen, in ſome caſes where the inflammation runs high, recourſe may be had with great advantage both to general blood-letting and to leeches applied at the anus. Relief is alſo often obtained from the external application of emollients, either alone or combined with different articles of the ſedative kind, as acetated ceruſe or opium, by which it is well known that pain in general, particularly when depending on increaſed ſenſibility, or augmented action of the veſſels, is powerfully allayed.

When the flux has actually come on, we are to moderate it as much as poſſible, by cauſing the patient to lie in a horizontal poſture on a hard bed; by avoiding exerciſe in an erect poſture, uſing a cool diet, and avoiding external heat. But with reſpect to the further cure of this diſeaſe, we muſt obſerve, that there are only two caſes in which it is common for hæmorrhoidal perſons to call for medical aſſiſtance. The one is, when the affection is accompanied with much pain; and the other, when the piles are accompanied with exceſſive bleeding. In the firſt caſe, we muſt conſider whether the piles be external or internal. The pain of the external piles happens eſpecially when a conſiderable protruſion of the rectum has taken place; and while it remains unreduced, it is ſtrangled by the conſtriction of the ſphincter; and at the ſame time no bleeding happens to take off the ſwelling of the protruded portion of the inteſtine; and ſometimes an inflammation ſupervenes, which greatly aggravates the pain. In this caſe, emollient fomentations and poultices are ſometimes of ſervice, but the application of leeches is generally to be preferred.

In caſe of exceſſive bleeding, we are on all occaſions to endeavour to moderate the flux, even where the diſeaſe has occurred as a critical diſcharge; for if the primary diſeaſe ſhall be entirely and radically cured, the preventing any return of the hæmorrhois ſeems perfectly ſafe and proper. It is only when the diſeaſe ariſes from a plethoric habit, and from a ſtagnation of blood in the hypochondriac region, or when, though originally topical, it has by frequent repetition become habitual and has thereby acquired a connection with the ſyſtem, that any doubt can ariſe about curing it entirely. In any of theſe caſes, however, Dr Cullen is of opinion that it will be proper to moderate the bleeding, leſt, by its continuance or repetition, the plethoric ſtate of the body, and the particular determination of the blood into the hæmorrhoidal veſſels, be increaſed, and the return of the diſeaſe be too much favoured. Dr Stahl is of opinion, that the hæmorrhoidal flux is never to be accounted exceſſive excepting when it occaſions great debility or leucophlegmatia: but Dr Cullen thinks, that the ſmalleſt approach towards producing either of theſe effects ſhould be conſidered as an exceſs which ought to be prevented from going farther; and even in the caſes of congeſtion and plethora, if the plethoric habit and tendency can be obviated and removed, the hæmorrhoidal flux may then with ſafety be entirely ſuppreſſed. In all caſes therefore of exceſſive bleeding, or any approach

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proach to it, astringents both internal and external may be safely and properly applied; not indeed to induce an immediate and total suppression; but to moderate the hæmorrhagy, and by degrees to suppress it altogether; while at the same time measures are to be taken for the removing the necessity of its recurrence.

245 GENUS XXXIX. MENORRHAGIA.
Immoderate Flow of the MENSES.

Menorrhagia, *Sauv.* 244. *Lin.* 202. *Vog.* 96.
Metrorrhagia, *Sag.* gen. 179.
Uteri hæmorrhagia, *Hoffm.* II. 224.
Hæmorrhagia uterina, *Junck.* 14.
Leucorrhœa, *Sauv.* gen. 267. *Lin.* 201. *Vog.* 119. *Sag.* gen. 202.
Cachexia uterino, sive fluor albus, *Hoffm.* III. 348.
Fluor albus, *Junck* 133.
Abortus, *Sauv.* gen. 245. *Lin.* 204. *Sag.* gen. 180. *Junck.* 92.
Abortio, *Vog.* 97.
Fluor uterini sanguinis, *Boerh.* 1303.
Convulsio uteri, sive abortus, *Hoffm.* III. 176.

246 Sp. I. The *Immoderate Flow* of the MENSES, properly so called.

Menorrhagia rubra, *Cul.*
Menorrhagia immodica, *Sauv.* sp. 3.
Menorrhagia stillatitia, *Sauv.* sp. 2.

Description. The quantity of the menstrual flux is different in different women, and likewise in the same woman at different times. An unusual quantity therefore is not always to be considered as morbid: but when a large flow of the menses has been preceded by headach, giddiness or dyspnœa; has been ushered in by a cold stage, and is attended with much pain of the back and loins, with a frequent pulse, heat and thirst; it may then be considered as preternaturally morbid. On the other hand, when the face becomes pale, the pulse weak, an usual debility is felt in exercise, and the breathing is hurried by little labour; when the back becomes pained from any continuance in an erect posture, when the extremities become frequently cold, and when at night the feet appear affected with œdematous swelling: from all these symptoms we may conclude, that the flow of the menses has been immoderate, and has already induced a dangerous state of debility. The debility, induced in this case, often appears also by affections of the stomach, an anorexia, and other symptoms of dyspepsia; by a palpitation of the heart, and frequent faintings; by a weakness of mind, liable to strong emotions from slight causes, especially those presented by surprise. A large flow of the menses attended with barrenness in married women, may generally be considered as preternatural and morbid. Generally, also, that flow of the menses may be considered as immoderate, which is preceded and followed by a leucorrhœa.

Causes, &c. The proximate cause of the menorrhagia is either the effort of the uterine vessels preternaturally increased, or a preternatural laxity of the extremities of the uterine arteries.—The remote causes may be, 1. Those which increase the plethoric state of the uterine vessels; as a full and nourishing diet, much strong liquor, and frequent intoxications. 2. Those which determine the blood more copiously and forcibly into the uterine vessels; as violent strainings of the whole body; violent shocks from falls; strokes or contusions on the lower belly; violent exercise, particularly in dancing; and violent passions of the mind. 3. Those which particularly irritate the vessels of the uterus; as excess in venery; the exercise of venery in the time of menstruation; a costive habit, giving occasion to violent straining at stool; and cold applied to the feet. 4. Those which have forcibly overstrained the extremities of the uterine vessels; as frequent abortions, frequent child-bearing without nursing, and difficult or tedious labours. Or, lastly, those which induce a general laxity; as living much in warm chambers, and drinking much of warm enervating liquors, such as tea, coffee, &c.

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Cure. The treatment and cure of the menorrhagia, must be different according to the different causes of the disease. The practices employed, however, are chiefly used with one or two intentions; either with the view of restrianing the discharge when present, or of preventing the return of an excessive discharge at the succeeding period. The first is chiefly to be accomplished by employing such practices as diminish the force occasioning the discharge of blood, or as augment the resistance to its passage through the vessels by which it is to be discharged. The last is in some degree to be obtained by avoiding causes which either increase the general impetus of the blood, or the impetus at the uterus in particular; but principally by giving additional vigour to the uterine vessels.

In all cases, the first attention ought to be given to avoiding the remote causes, whenever that can be done; and by such attention the disease may be often entirely cured. When the remote causes cannot be avoided, or when the avoiding them has been neglected, aud a copious menstruation has come on, it should be moderated as much as possible, by abstaining from all exercise at the coming on or during the continuance of the menstruation; by avoiding even an erect posture as much as possible; by shunning external heat, and of course warm chambers and soft beds; by using a light and cool diet; by taking cold drink, at least as far as former habits will allow; by avoiding venery; by obviating costiveness, or removing it by laxatives which give little stimulus. The sex are commonly negligent, either in avoiding the remote causes, or in moderating the first beginnings of this disease. It is by such neglect that it so frequently becomes violent and of difficult cure; and the frequent repetition of a copious menstruation may be considered as a cause of great laxity in the extreme vessels of the uterus.

When the coming on of the menstruation has been preceded by some disorder in other parts of the body, and is accompanied with pains of the back, somewhat like parturient pains, with febrile symptoms, and when at the same time the flow seems to be copious, a bleeding at the arm may be proper, but is not often necessary; and it will in most cases be sufficient to employ, with great attention and diligence, those means already mentioned for moderating the discharge.

When the immoderate flow of the menses shall seem

to

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to be owing to a laxity of the veſſels of the uterus, as may be concluded from the general debility and laxity of the perſon's habit; from the remote cauſes that have occaſioned the diſeaſe; from the abſence of the ſymptoms which denote increaſed action in the veſſels of the uterus; from the frequent recurrence of the diſeaſe; and particularly from this, that the female in the intervals of menſtruation is liable to a leucorrhœa: in ſuch a caſe, the diſeaſe is to be treated, not only by employing all the means abovementioned for moderating the hemorrhagy, but alſo by avoiding all irritation, every irritation having a greater effect in proportion as the veſſels are more lax and yielding. If, in ſuch a caſe of laxity, it ſhall appear that ſome degree of irritation concurs, opiates may be employed to moderate the diſcharge; but in uſing theſe much caution is requiſite. If, notwithſtanding theſe meaſures having been taken, the diſcharge ſhall prove very large, aſtringents both external and internal may be employed. In ſuch caſes, Dr Cullen aſks, May ſmall doſes of emetics be of ſervice?

When the menorrhagia depends on the laxity of the uterine veſſels, it will be proper, in the intervals of menſtruation, to employ tonic remedies; as cold bathing and chalybeates. The exerciſes of geſtation alſo may be very uſeful, both for ſtrengthening the whole ſyſtem, and for taking off the determination of the blood to the internal parts.

Theſe remedies may be employed in all caſes of menorrhagia, from whatever cauſe it may have proceeded, it ſhall have already induced a conſiderable degree of debility in the body.

247 Sp. II. Abortion.

Menorrhagia abortus, *Cul.*
Menorrhagia gravidarum, *Sauv.* ſp. 6.
Abortus effluxio, *Sauv.* ſp. 1.
a. Abortus ſubtrimeſtris.
b. Abortus ſubſemeſtris.
c. Abortus octimeſtris.
Abortus ab uteri laxitate, *Sauv.* ſp. 2.

248 Sp. III. *Immoderate Flux* of the Lochia.

Menorrhagia lochialis, *Sauv.* ſp. 8 *Cul.*

For the deſcription, treatment and cure, of theſe two laſt diſeaſes, ſee the article Midwifery.

249 Sp. IV. *Immoderate Flow* of the Menses from ſome Local Diſorder.

Menorrhagia vitiorum, *Cul.*
Menorrhagia ex hyſteroptoſi, *Sauv.* Sp. 5.
Menorrhagia ulceroſa, *Sauv.* ſp. 9.

250 Sp. V. The *Leucorrhœa, Fluor Albus*, or *Whites.*

Menorrhagia alba, *Cul.*
Leucorrhœa, *Sauv.* G 267.
Menorrhagia decolor, *Sauv.* ſp. 7
Leucorrhœa Americana *Sauv.* ſp. 5.
Leucorrhœa Indica, *Sauv.* ſp. 6.
Leucorhœa Nabothi, *Sauv.* ſp. 9.
Leucorrhœa gravidarum, *Sauv.* ſp. 8.

Deſcription. The *fluor albus*, female weakneſs, or *whites*, as it is commonly called, is a diſeaſe of the womb and its contiguous parts; from which a pale coloured, greeniſh, or yellow fluid, is diſcharged, attended with loſs of ſtrength, pain in the loins, bad digeſtion, and a wan ſickly aſpect.

Leucorrhœa.

Cauſes, &c. The quantity, colour, and conſiſtence of the diſcharge, chiefly depend upon the time of its duration, the patient's habit of body, and the nature of the cauſe by which it was produced. Taking cold, ſtrong liquor, immoderate heat and moiſture, or violent exerciſe, are all obſerved to produce a bad effect, as to its quantity and quality.

Weakly women of lax ſolids, who have had many children, and long laboured under ill health, are of all the moſt ſubject to this diſagreeable diſeaſe; from which they unfortunately ſuffer more ſevere penance than others, as the niceſt ſenſations are often connected with ſuch a delicacy of bodily frame as ſubjects them to it.

In Holland it is very frequent and in a manner peculiar to the place, from the dampneſs of its ſituation; the ſurrounding air being ſo overcharged with moiſture as to relax the body, ſtop perſpiration, and throw it upon the bowels or womb; producing in the firſt a diarrhœa or flux, in the laſt the *fluor albus* or female weakneſs.

The diſcharge often proceeds from the veſſels ſubſervient to menſtruation; becauſe, in delicate habits, where thoſe veſſels are weak, and conſequently remain too long uncontracted, the *fluor albus* ſometimes immediately follows the menſes, and goes off by degrees as they gradually cloſe. It alſo comes from the mucous glands of the womb, as is particularly evident in very young females of eight and ten years old; in whom, though very rarely, it has been obſerved, and where it muſt then have neceſſarily eſcaped from thoſe parts, as the uterine veſſels are not ſufficiently enlarged for its paſſage at ſo early a period.

Sometimes, as in women with child, it proceeds from the paſſage to the womb, and not from the womb itſelf; which, during pregnancy, is cloſely ſealed up, ſo that nothing can paſs from thence till the time of labour. The application of thoſe inſtruments called *peſſaries*, from the pain and irritation they occaſion, are alſo apt to bring on this diſcharge. Hence we may conclude, that this diſeaſe may happen although the blood be in a pure ſtate. Here the fault ſeems to be placed in the veſſels at the part, by which the fluids are vitiated and changed from their natural qualities.

The *fluor albus* has been ſuppoſed to ſupply the want of the menſes; becauſe where the firſt prevails, the laſt is generally either irregular or totally wanting: but it might more properly be ſaid, that the preſence of the *fluor albus*, which is a preternatural evacuation, occaſions the abſence of that which is natural; as is evident from the return of the menſes after the *fluor albus* has been cured. Indeed, when this diſcharge appears about the age of 13 or 14, and returns once a month, with ſymptoms like thoſe of the menſes, then it may be deemed ſtrictly natural, and therefore ought not to be ſtopped.

Prognoſis. The *fluor albus* may be diſtinguiſhed into two kinds. The firſt ariſes from a ſimple weakneſs, or the relaxation of the ſolids; which may either be *general*, where the whole bodily ſyſtem is enervated, and unſtrung; or *partial*, where the womb only is thus affected,

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affected in consequence of hard labour, frequent miscarriages, a suppression or immoderate quantity of the menses, or a sprain of the back or loins,

In the first case, the discharge being generally mild, may be safely taken away. In the second it may proceed from a vitiated or impure blood, where the body from thence, is loaded with gross humours, which nature for her own security and relief thus endeavours to carry off. In such cases, the discharge is often of a reddish colour, like that from old ulcerous sores; being sometimes so sharp as to excoriate the contiguous parts, and occasion a smarting and heat of urine.

A deep-seated, darting pain, with a forcing down, attending such a discharge, is a very dangerous and alarming sign, and indicates an ulceration or cancerous state of the womb. This malignant state of the disease, if of long continuance, is extremely difficult of cure; and disposes the patient to barrenness, a bearing down, dropsy, or consumption.

Cure, &c. The causes of those two kinds of this disease being different, so they will require a very different method of cure. For this purpose, in the first case, nothing will be more proper than nourishing simple food; such as veal broths, jellies, fresh eggs, and milk diet. The acid fruits will also be proper; and the patient may take a restorative, strengthening infusion, which will give firmness to the body, and assist the weakened fibres of the womb in returning to their natural state.

The same method may be used with success, where the *fluor albus* follows the menses as already observed.

The Tunbridge or Spa waters may be drank at the same time and if necessary, an infusion of green tea, or pure smith's forge water, may be used with a womb-syringe as an injection twice a-day. Should the disease prove uncommonly obstinate, the patient may go into the cold bath every second day; and also drink lime-water with milk, which will expedite the cure, and prevent a relapse. Volatile liniment, and afterwards a strengthening plaster, may be applied to the small of the back.

By way of caution, the female should abstain from the immoderate use of tea; and be removed into a dry clear air; or if she be obliged to remain in one less proper, she may apply the flesh-brush, and wear a flannel shift next her skin, impregnated with the fumes of burning frankincense or any of the grateful aromatic gums. Cold spring-water pumped on the loins, or a blistering plaster applied to the bottom of the spine or back, are both very powerful in their effects, and have sometimes succeeded after other remedies had been tried in vain.

In the second sort of the disease, where the discharge is sharp and of long standing, it would be extremely dangerous to suppress it suddenly, either by astringents internally taken, or applied as injections, until the system be restored to a more sound and vigorous condition.

A purging potion may be taken twice a-week, and in the intervals an alterative pill night and morning. After this course has been continued a fortnight or three weeks, she may begin with the strengthening bitter infusion, or some other tonic, in the quantity of a tea-cupful twice a-day, or to a greater extent if the stomach will allow.

Leucorrhœa

The same sort of food and regimen will here be proper as in the first kind of the disease. The patient should abstain from malt liquors, and drink rice-water, in each pint of which half an ounce of gum-arabic has been dissolved; or if she be weak, and of a cold bloated habit of body, a little French brandy may be added occasionally.

When she begins to take the bitter infusion, it will be proper to use the Tunbridge or Pyrmont water for common drink; but if those cannot conveniently be had, the *artificial aërated water*, impregnated with iron and fixed air, will make an excellent substitute. If it should render her costive, and occasion head-ach, she may desist, and drink imperial water or a little senna-tea sweetened with manna, till those complaints be removed.

In short, as this is a malady of the most disagreeable kind, which by long continuance or neglect becomes difficult of cure and often produces an *ulceration of the womb, bearing down, barrenness*, a *dropsy*, or *consumption*; it were to be wished that women, on such occasions, would be more attentive to their own safety, by using all possible means, in due time, to prevent those disorders.

Dr Leake says he has attended more patients labouring under the *fluor albus* in the autumn than at any other season of the year, especially when the weather was uncommonly moist and cold: most of them were cured by change of diet, an increased perspiration, and the proper use of Peruvian bark with aromatics. He observed, that several about this time who escaped the disorder, were visited with bad colds, a defluxion on the throat, or a diarrhœa, which were removed by a similar treatment.

As women are sometimes connected with those who do not conscientiously regard their safety, it is a circumstance of the utmost consequence *to distinguish a fresh venereal infection from the fluor albus or whites*: for if the first be mistaken for the last, and be either neglected or improperly treated, the worst consequences may arise.

The following signs will best inform the patient whether there be occasion for her doubts or not.

A fresh infection, called *gonorrhœa*, is malignant and inflammatory; the *fluor albus* most commonly arises from relaxation and bodily weakness: and therefore the remedies proper in the first disorder would render the last more violent, by locking up and confining the infectious matter.

In the gonorrhœa, the discharge chiefly proceeds from the parts contiguous to the urinary passage, and continues whilst the menses flow but in the *fluor albus* it is supplied from the cavity of the womb and its passage, and then the menses are seldom regular.

In the gonorrhœa, an itching, inflammation, and heat of urine, are the fore-runners of the discharge; the orifice of the urinary passage is prominent and painful, and the patient is affected with a frequent irritation to make water. In the *fluor albus*, pains in the loins, and loss of strength, attend the discharge; and if any inflammation or heat of urine follow, they happen in a less degree, and only after a long continuance

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tinuance of the discharge, which, becoming sharp and acrimonious, excoriates the surrounding parts.

In the gonorrhœa, the discharge suddenly appears without any evident cause; but in the *fluor albus*, it comes on more slowly, and is often produced by irregularities of the menses, frequent abortion, sprains, or long-continued illness.

In the gonorrhœa, the discharge is greenish or yellow, less in quantity, *and not attended with the same symptoms of weakness*. In the *fluor albus*, it is also often of the same colour, especially in bad habits of body, and after long continuance; but is usually more offensive, and redundant in quantity.

All the other kinds of hemorrhagy enumerated by medical writers, are by Dr Cullen reckoned to be symptomatic; as,

STOMACACE, *Sauv.* gen. 241. *Lin.* 175. *Vog.* 85. *Sag.* gen. 176.

Species: Scorbutica, Purulenta, &c.

HÆMATEMESIS, *Sauv.* gen. 242. *Lin.* 184. *Vog.* 89. gen. 177.

Species: Plethorica, Catamenialis, Scorbutica, &c.

HÆMATURIA, *Sauv.* gen. 233. *Lin.* 198. *Vog.* 92. *Sag.* gen. 178.

Species: Purulenta, Calculosa, Hæmorrhoidalis, &c.

ORDER V. PROFLUVIA.

251 GENUS XL. CATARRHUS.
The CATARRH.

Catarrhus, *Sauv.* gen. 186. *Vog.* 98. *Sag.* gen. 145.
Coryza, *Lin.* 174. *Vog.* 100. *Sag.* gen. 196.
Rheuma, *Sauv.* gen. 142.
Tussis, *Sauv.* gen 142. *Lin*, 155. *Vog.* 205. *Sag.* gen. 245. 255. *Junck.* 30.
Tussis catarrhalis et rheumatica, *Hoffm.* III. 109.

252 Sp. I. *Catarrh* from COLD

Catarrhus a frigore, *Cul.*
Catarrhus benignus, *Sauv.* sp. 1.
Catarrhus pectoreus, *Sauv.* sp. 6.
Coryza catarrhalis, *Sauv.* sp. 1.
Coryza phlegmatorrhagia, *Sauv.* sp. 2. *Salmuth.* Obs. cent. 1. 37. *Junck.* 28. *Morgagn.* de sed. xiv. 21.
Coryza febricosa, *Sauv.* sp. 6.
Tussis catarrhalis, *Sauv.* sp. 1. *N. Rosen* Diss. apud *Haller*, Disput. Pract. tom. II.
Rheuma catarrhale, *Sauv.* sp. 1.
Amphimerina catarrhalis, *Sauv.* sp. 2.
Amphimerina tussiculosa, *Sauv.* sp. 13.
Cephalalgia catarrhalis, *Sauv.* sp. 10.

253 Sp. II. *Catarrh* from CONTAGION.

Catarrhus a contagio, *Cul.*
Catarrhus epidemicus, *Sauv.* sp. 3.
Rheuma epidemicum, *Sauv.* sp. 2.
Synocha catarrhalis, *Sauv.* sp. 5.

There are several symptomatic species: as, Catarrhus Rubeolosus; Tussis Variolosa, Verminosa, Calculosa, Phthisica, Hysterica, a dentitione, Gravidarum, Metallicolarum, &c.

Catarrhus.

Description. The catarrh is an increased excretion of mucus from the mucous membrane of the nose, fauces, and bronchiæ, attended with pyrexia.

Practical writers and nosologists have distinguished the disease by different appellations, according as it appears to affect different parts of the mucous membrane, one part more or less than the other: but Dr Cullen is of opinion that the disease in those different parts is always of the same nature, and proceeds from the same cause in the one as in the other. Very commonly indeed those different parts are affected at the same time; and therefore there is little room for the distinction mentioned. The disease has been frequently treated of under the title of *tussis* or *cough*; and a cough, indeed, always attends the chief form of catarrh, that is, the increased excretion from the bronchiæ; but as it is so often also a symptom of many other affections, which are very different from one another, it is improperly used as a generic title.

The disease generally begins with some difficulty of breathing through the nose, and with a sense of some fulness stopping up that passage. This again is often attended with some dull pain and a sense of weight in the forehead, as well as a stiffness in the motion of the eyes. These feelings, sometimes at their very first beginning, and always soon after, are attended with the distillation of a thin fluid from the nose, and sometimes from the eyes; and these fluids are often found to be somewhat acrid, both by their taste and by their fretting the parts over which they pass. These symptoms constitute the coryza and gravedo of authors, and are commonly attended with a sense of lassitude over the whole body. Sometimes cold shiverings are felt; at least the body is more sensible than usual to the coldness of the air; and with all this the pulse is more frequent than ordinary, especially in the evenings.

These symptoms have seldom continued long before they are accompanied with some hoarseness, and a sense of roughness and soreness in the trachea, with some difficulty of breathing, expressed by a sense of straitness in the chest, and with a cough which seems to arise from some irritation felt at the glottis. This cough is generally at first dry and painful, occasioning pains about the chest, and more especially in the breast; sometimes, together with these symptoms, pains resembling those of the rheumatism are felt in several parts of the body, particularly about the neck and head. With all these symptoms, the appetite is impaired, some thirst arises, and a feverish lassitude is felt all over the body. These symptoms, mark the height and violence of the disease; but commonly it does not continue long. By degrees the cough comes to be attended with a more copious excretion of mucus; which is at first thin, but gradually becoming thicker, is brought up with less frequent and less laborious coughing. The hoarseness and soreness of the treachea are also relieved or removed; and the febrile symptoms abating, the expectoration becomes again less, and the cough less frequent, till at length they cease altogether.

Such is generally the course of this disease, neither

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tedious nor dangerous; but it is ſometimes in both reſpects otherwiſe. The body affected with catarrh ſeems to be more than uſually liable to be affected by cold air; and upon expoſure of the body to freſh cold, the diſeaſe, which ſeemed to be yielding, is often brought back with greater violence than before, and is rendered not only more tedious than otherwiſe it would be, but alſo more dangerous by the ſupervening of other diſeaſes. Some degree of the cynanche tonſillaris often accompanies the catarrh; and when this is aggravated by a freſh application of cold, the cynanche alſo becomes more violent and dangerous from the cough, which is preſent at the ſame time. When a catarrh has been occaſioned by a violent cauſe, when it has been aggravated by improper management, and eſpecially when it has been rendered more violent by freſh and repeated applications of cold, it often paſſes into a pneumonic inflammation, attended with the utmoſt danger.

Unleſs, however, ſuch accidents as thoſe happen, a catarrh, in ſound perſons not far advanced in life, is always a ſlight and ſafe diſeaſe; but, in perſons of a phthiſical diſpoſition, a catarrh may readily produce a hemoptyſis, or perhaps form tubercles in the lungs; and ſtill more readily in perſons who have tubercles already formed in the lungs, an accidental catarrh may occaſion the inflammation of theſe tubercles, and in conſequence produce a phthiſis pulmonalis.

In elderly perſons, a catarrh ſometimes proves a dangerous diſeaſe. Many perſons, as they advance in life, and eſpecially after they have arrived at old age, have the natural mucus of the lungs poured out in greater quantity, and requiring a frequent expectoration. If, therefore, a catarrh happen to ſuch perſons, and increaſe the afflux of fluids to the lungs, with ſome degree of inflammation, it may produce the peripneumonia notha, or more properly chronic catarrh, a diſeaſe continuing often for many years, or at leaſt regularly every winter; which in ſuch caſes is very often fatal.

Cauſes, &c. The proximate cauſe of catarrh ſeems to be an increaſed afflux of fluids to the mucous membrane of the noſe, fauces, and bronchiæ, along with ſome degree of inflammation affecting the ſame. The latter circumſtance is confirmed by this, that, in the caſe of catarrh, the blood drawn from a vein commonly exhibits the ſame inflammatory cruſt which appears in the caſe of phlegmaſiæ. The remote cauſe of catarrh is moſt commonly cold applied to the body. This application of cold producing catarrh is generally evident and obſerved; and Dr Cullen is of opinion that it would always be ſo, were men acquainted with and attentive to the circumſtances which determine cold to act upon the body.

The application of cold which occaſions a catarrh, probably operates by ſtopping the perſpiration uſually made by the ſkin, and which is therefore determined to the mucous membrane of the parts abovementioned. As a part of the weight which the body daily loſes by inſenſible evacuation, is owing to an exhalation from the lungs, there is probably a connection between this exhalation and the cutaneous perſpiration, ſo that the one may be increaſed according as the other is diminiſhed; and therefore we may underſtand how the diminution of cutaneous perſpiration, by the application of cold, may increaſe the afflux of fluids to the lungs, and thereby produce a catarrh.

Catarrhus.

Dr Cullen obſerves that there are ſome obſervations of Dr James Keil which may render this matter doubtful; but ſays there is a fallacy in thoſe obſervations. The evident effects of cold in producing coryza, leave the matter, in general, without doubt; and there are ſeveral other obſervations which ſhow a connexion between the lungs and the ſurface of the body.

Whether from the ſuppreſſion of perſpiration, a catarrh be produced merely by an increaſed afflux of fluids, or whether in addition to this the matter of perſpiration be at the ſame time determined to the mucous glands, and there excites a particular irritation, may be uncertain; but Dr Cullen thinks the latter ſuppoſition is moſt probable.

Although in the caſe of a common catarrh, which is in many inſtances ſporadic, it may be doubtful whether any morbific matter be applied to the mucous glands; we are, however, certain that the ſymptoms of a catarrh do frequently depend upon ſuch a matter being applied to theſe glands, as appears from the caſe of meaſles, chincough, and eſpecially from the frequent occurrence of contagious and epidemical catarrh.

The phenomena of contagious catarrhs have been much the ſame with thoſe of the others; and the diſeaſe has always been particularly remarkable for this, that it has been the moſt widely and generally ſpreading epidemic known. It has ſeldom appeared in any one country of Europe, without appearing ſucceſſively in almoſt every different part of it; and, in ſome inſtances, it has been alſo transferred to America, and has been ſpread there in like manner, ſo far as we have had opportunities of being informed.

The catarrh from contagion appears with nearly the ſame ſymptoms as thoſe abovementioned. It ſeems often to come on in conſequence of the application of cold. And indeed catarrh from cold and contagion are in every reſpect ſo ſimilar, that when this epidemic rages, it is impoſſible to determine with a perſon having ſymptoms of catarrh after expoſure to cold, whether the diſeaſe proceeds from the one cauſe or the other. In moſt inſtances, however, catarrh from contagion comes on with more cold ſhivering than the catarrh ariſing from cold alone; and the former does alſo not only ſooner ſhow febrile ſpmptoms, but to a more conſiderable degree. Accordingly, it more ſpeedily runs its courſe, which is commonly finiſhed in a few days. It ſometimes ends by a ſpontaneous ſweat; and this, in ſome perſons, produces a miliary eruption. It is, however, the febrile ſtate of this diſeaſe eſpecially that is finiſhed in a few days; for the cough and other catarrhal ſymptoms do frequently continue longer, and often when they appear to be going off they are renewed by any freſh application of cold.

Prognoſis. Conſidering the number of perſons who are affected with catarrh, of either the one ſpecies or the other, and eſcape from it quickly without any hurt, it may be allowed to be a diſeaſe commonly free from danger; but it is not always to be treated as ſuch, for

Profluvia for in ſome perſons it is accompanied with pneumonic inflammation. In the phthiſically diſpoſed, it often accelerates the coming on of phthiſis; and in elderly perſons it often proves fatal in the manner we have explained above, viz. by degenerating into its chronic ſtate. But though chronic catarrh be often the termination of that ſpecies which ariſes from cold, we have not, in any caſe, obſerved it to ariſe as a conſequence of a catarrh from contagion. This ſpecies of catarrh, however, is not unfrequently followed by phthiſis; or rather where a phthiſical tendency before exiſted, the affection has been begun and its progreſs accelerated from this cauſe.

Cure. The cure of catarrh is nearly the ſame, whether it proceeds from cold or contagion; only in the latter caſe remedies are commonly more neceſſary than in the former. In the caſes of a moderate diſeaſe, it is commonly ſufficient to avoid cold, or to abſtain from animal-food for ſome days. In ſome caſes, where the febrile ſymptoms are conſiderable, it is proper for that length of time to lie a-bed, and, by taking frequently ſome mild and diluent drink, a little warmed, to promote a very gentle ſweat; and after this to take care to return very gradually only to the uſe of the free air. When the diſeaſe is more violent, not only the antiphlogiſtic regimen, exactly obſerved, but various remedies alſo, become neceſſary. To take off the phlogiſtic diatheſis which always attends this diſeaſe, blood-letting, more or leſs, according as the ſymptoms ſhall require, is the proper remedy. After blood-letting, for reſtoring the determination of the fluids to the ſurface of the body, and at the ſame time for expediting the ſecretion of mucus in the lungs, which may take off the inflammation of its membrane, vomiting is the moſt effectual means. For the laſt-mentioned purpoſe, it has been ſuppoſed that ſquills, gum-ammoniac, the volatile alkali, and ſome other medicines, might be uſeful; but their efficacy has never been found conſiderable: and if ſquills have ever been very uſeful, it ſeems to have been rather by their emetic than by their expectorant powers. When the inflammatory affections of the lungs ſeem to be conſiderable, it is proper, beſides blood-letting, to apply bliſters to the back or ſides.

As a cough is often the moſt troubleſome circumſtance of this diſeaſe, ſo demulcents may be employed to alleviate it. But after the inflammatory ſymptoms are much abated, if the cough ſtill remains, opiates afford the moſt effectual means of relieving it; and, in the circumſtances juſt now mentioned, they may be very ſafely employed. Very conſiderable advantage is often derived from employing opiates in ſuch a manner as to act more immediately on the head of the wind-pipe. For this purpoſe, opium may often be advantageouſly conjoined with demulcents, melting ſlowly in the mouth. And perhaps no form is more convenient, or anſwers the purpoſe better, than the *trochiſci glycyrrhizæ cum opio* of the Edingburgh Pharmacopœia, where purified opium is combined with extract of liquorice, gum Arabic, and other demulcents, to the extent of about a grain in a dram of the compoſition. After the inflammatory and febrile ſtates of this diſeaſe are very much gone, the moſt effectual means of diſcuſſing all remains of the catarrhal affection is by ſome exerciſe of geſtation diligently employed. Catarrhus.

Beſides the remedies abovementioned, Mr Mudge, in a treatiſe on this diſeaſe, recommends the ſteam of warm water as a moſt efficacious and ſafe remedy for a catarrh, and which indeed he ſeems to conſider as little leſs than *infallible*. The method of breathing in theſe ſteams is deſcribed under the word INHALER; but he gives a caution to people in health, who may accidentally ſee his machine, not to make the experiment of breathing through cold water with it, or they will be almoſt certain of catching a ſevere cold. His directions for thoſe troubled with the catarrh are as follow:

"In the evening, a little before bed-time, the patient, if of adult age, is to take three drachms, or as many tea-ſpoonfuls, of elixir paregoricum, in a glaſs of water: if the ſubject be younger, for inſtance under five years old, one tea-ſpoonful; or within that and ten years, two. About three quarters of an hour after, the patient ſhould go to bed, and, being covered warm the inhaler three parts filled with water nearly boiling (which, from the coldneſs of the metal, and the time it ordinarily takes before it is to be uſed by the patient, will be of a proper degree of warmth), and being wrapped up in a napkin, but ſo that the valve in the cover is not obſtructed by it, is to be placed at the arm-pit, and the bed-cloathes being drawn up and over it cloſe to the throat, the tube is to be applied to the mouth, and the patient ſhould inſpire and expire through it for about twenty minutes or half an hour.

"It is very evident, as the whole act of reſpiration is performed through the machine, that in inſpiration the lungs will be filled with air which will be hot, and loaded with vapour, by paſſing through the body of water; and in exſpiration, all that was contained in the lungs will, by mixing with the ſteam on the ſurface of the water, be forced thro' the valve in the cover, and ſettle on the ſurface of the body under the bed-cloaths.

"The great uſe of this particular conſtruction of the inhaler is this. Firſt, as there is no neceſſity, at the end of every inſpiration, to remove the tube from the mouth, in order to exſpire from the lungs the vapour which had been received into them, this machine may therefore be uſed with as much eaſe by children as older people. And, ſecondly, as a feveriſh habit frequently accompanies the diſorder, the valve in that reſpect alſo is of the utmoſt importance; for a ſweat, or at leaſt a free perſpiration, not only relieves the patient from the reſtleſs anxiety of a hot, dry, and ſometimes parched ſkin, but is alſo, of all evacuations, the moſt eligible for removing the fever; and it will be generally found, that, after the inhaler ſo conſtructed has been uſed a few minutes, the warm vapour under the cloaths will, by ſettling upon the trunk, produce a ſweat, which will gradually extend itſelf to the legs and feet.

"In a catarrhous fever, or any feveriſh habit attending this cough, it would he proper to take a draught of warm thin whey a few minutes before the inhaler be uſed; and after the proceſs is over, the ſweat which it has produced may be continued by occaſional

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ſmall draughts of weak warm whey or barley-water. The ſweating is by no means ſo neceſſary to the cure of the catarrhous cough, as that the ſucceſs of the inhaler againſt that complaint at all depends upon it; yet I cannot help once more remarking, that when this diſorder happens to be accompanied with a feveriſh habit, the advantages of this particular conſtruction will be very important.

"After this reſpiratory proceſs is over, the patient uſually paſſes the night without the leaſt interruption from the cough, and feels no farther moleſtation from it than once or twice in the morning to throw off the trifling leakage which, unperceived, had dripped into the bronchiæ and veſicles during the night; the thinner parts of which being evaporated, what remains is ſoon got rid of with a very gentle effort.

"I cannot, however, take leave of this part of my ſubject, without pointedly obſerving, that if the patient means not to be diſappointed by my aſſurances or his own expectations, it is eſſentially neceſſary that the following remarks, with regard to the time and manner of uſing this proceſs, ſhould be ſtrictly attended to.

"Firſt, That as tender valetudinary people are but too well acquainted with the firſt notices of the diſorder, the remedy muſt, or ought to be, uſed the ſame evening; which will, in an ordinary ſeizure, be attended with an immediate cure: but if the foreneſs of the reſpiratory organs, or the petulance of the cough, ſhow the cold which has been contracted to have been very ſevere, the inhaler, without the opiate, ſhould be again repeated for the ſame time the next morning.

"Secondly, if the uſe of the inhaler, &c. be delayed till the ſecond night, it will be always right to repeat it again the next morning without the opiate, but with it if the ſeizure has been violent.

"And, laſtly, if the cough be of ſome days ſtanding, it will be always neceſſary to employ both parts of the proceſs at night and the ſucceeding morning, as the firſt ſimple inflammatory miſchief is now moſt probably aggravated by an additional one of a chronic tendency.

"But if, through the want of a timely application or a total neglect of this or any other remedy, the cough ſhould continue to haraſs the patient, it is, particularly in delicate and tender conſtitutions, of the utmoſt conſequence to attempt the removal of it as ſoon as poſſible, before any floating acrimony in the conſtitution (from the perpetual irritation) receives an habitual determination to an organ ſo eſſential to life as the lungs.

"If the patient expectorate with eaſe and freedom a thick and well-digeſted inoffenſive phlegm, there is generally but little doubt of his ſpitting off the diſorder, with common care, in a few days; and till that be accompliſhed, a proper doſe of elixir paregoricum for a few ſucceſſive nights will be found very uſeful in ſuppreſſing the fatiguing irritation and ineffectual cough, occaſioned by a matter which, dripping in the early ſtate of the diſeaſe into the bronchiæ during the night, is commonly at that time too thin to be diſcharged by thoſe convulſive efforts.

"If, however, notwithſtanding a free and copious expectoration, the cough ſhould ſtill continue, and the diſcharge, inſtead of removing the complaint, ſhould

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itſelf, by becoming a diſeaſe, be a greater expence than the conſtitution can well ſupport, it is poſſible than a tender patient may ſpit off his life through a weak, relaxed pair of lungs, without the leaſt appearance of purulence, or any ſuſpicion of ſuppuration. In thoſe circumſtances, beſides, as was mentioned before, increaſing the general perſpiration by the ſalutary friction of a flannel waiſtcoat, change of ſituation, and more eſpecially long journeys on horſeback, conducted as much as poſſible through a thin, ſharp, dry air, will ſeldom fail of removing the complaint.

"But on the contrary, if the cough ſhould, at the ſame time that it is petulant and fatiguing to the breaſt, continue dry, huſky, and without expectoration; provided there be reaſon to hope that no tubercles are forming, or yet actually formed, there is not perhaps a more efficacious remedy for it than half a drachm of gum ammoniacum, with 18 or 20 drops of liquid laudanum, made into pills, and taken at bedtime, and occaſionally repeated. This excellent remedy Sir John Pringle did me the honour to communicate to me; and I have accordingly found it, in a great many inſtances, amazingly ſucceſſful, and generally very expeditiouſly ſo; for it ſeldom fails to produce an expectoration, and to abate the diſtreſſing fatigue of the cough. In thoſe circumſtances I have likewiſe found the common remedy of ʒſs or ℈ij of *balſ. ſulph. aniſat.* taken twice a-day, in a little powdered ſugar or any other vehicle, a very efficacious one. I have alſo, many times, known a ſalutary revulſion made from the lungs by the ſimple application of a large plaſter, about five or ſix inches diameter, of Burgundy pitch between the ſhoulders; for the perſpirable matter, which is locked up under it, becomes ſo ſharp and acrid, that in a few days it ſeldom fails to produce a very conſiderable itching, ſome little tendency to inflammation, and very frequently a great number of boils. This application ſhould be continued (the plaſter being occaſionally changed), for three weeks or a month, or longer, if the complaint be not ſo ſoon removed.

"And here I cannot help obſerving, that, though ſeemingly a trifling, it is however by no means a uſeleſs caution to the tender patient, not to expoſe his ſhoulders in bed, and during the night, to the cold; but when he lies down to take care they be kept warm, by drawing the bed-cloathes up cloſe to his back and neck.

"If, however, notwithſtanding theſe and other means, the cough continuing dry or unattended with a proper expectoration, ſhould perſevere in haraſſing the patient; if, at laſt, it ſhould produce, together with a foreneſs, ſhooting pains through the breaſt and between the ſhoulders, attended alſo with ſhortneſs of the breath; and if, added to this, flushes of the cheeks after meals, ſcalding in the hands and feet, and other ſymptoms of a hectic, ſhould accompany the diſorder; there is certainly no time to be loſt, as there is the greateſt reaſon to apprehend that ſome acrimony in the habit is determined to the tender ſubſtance of the lungs, and that conſequently tubercular ſuppurations will follow. In this critical and dangerous ſituation, I think I can venture to ſay from long experience, that, accompanied with change of air and occaſional bleedings, the patient will find his greateſt ſe-

Profluvia curity in a drain from a large scapulary issue, assisted by a diet of asses milk and vegetables."

254 GENUS XLI. DYSENTERIA.
The DYSENTERY.

Dysenteria, *Sauv.* gen. 248. *Lin.* 191. *Vog.* 107. *Sag.* 183. *Hoffm.* III. 151. *Junck.* 76.

Description. The dysentery is a disease in which the patient has frequent stools, accompanied with much griping, and followed by a tenesmus. The stools, though frequent, are generally in small quantity; and the matter voided is chiefly mucus, sometimes mixed with blood. At the same time, the natural fæces seldom appear; and when they do, it is generally in a compact and hardened form, often under the form of small hard substances known by the name of *scybalæ*. This disease occurs especially in summer and autumn, at the same time with autumnal intermittent and remittent fevers; and with these it is often complicated. It comes on sometimes with cold shiverings, and other symptoms of pyrexia; but more commonly the symptoms of the topical affection appear first. The belly is costive, with an unusual flatulence in the bowels. Sometimes, though more rarely, some degree of diarrhœa is the first appearance.—In most cases, the disease begins with griping, and a frequent inclination to go to stool. In indulging this, little is voided, but some tenesmus attends it. By degrees the stools become more frequent, the griping more severe, and the tenesmus more considerable.—With these symptoms there is a loss of appetite, and frequently sickness, nausea, and vomiting, also affecting the patient. At the same time there is always more or less of pyrexia present. It is sometimes of the remittent kind, and observes a tertian period.—Sometimes the pyrexia is manifestly inflammatory, and very often of a putrid kind. These febrile states continue to accompany the disease during its whole course, especially when it terminates soon in a fatal manner. In other cases, the febrile state almost entirely disappears, while the proper dysenteric symptoms remain for a long time after. In the course in the disease, whether for a shorter or a longer time, the matter voided by stool is very various. Sometimes it is merely a mucous matter, without any blood, exhibiting that disease which is named by some the *morbus mucosus*, and by others the *dysenteria alba*. For the most part, however, the mucus discharged is more or less mixed with blood. This sometimes appears only in streaks among the mucus; but at other times is more copious, giving a tinct to the whole; and upon some occasions a pure and unmixed blood is voided in considerable quantity. In other respects, the matter voided is variously changed in colour and consistence, and is commonly of a strong and unusually fetid odour. It is probable, that sometimes a genuine pus is voided, and frequently a putrid sanies, proceeding from gangrenous parts. There are very often mixed with the liquid matter some films of a membraneous appearance, and frequently some small masses of a seemingly sebaceous matter. While the stools voiding these various matters are, in many instances, exceedingly frequent, it is seldom that natural fæces appear in them; and when they do appear, it is, as we have said, in the form of scybala, that is, in somewhat hardened, separate balls. When these are voided, whether by the efforts of nature or as solicited by art, they procure a remission of all the symptoms, and more especially of the frequent stools, griping, and tenesmus. Dysenteria.

Accompanied with these circumstances, the disease proceeds for a longer or a shorter time. When the pyrexia attending it is of a violent inflammatory kind, and more especially when it is of a very putrid nature, the disease often terminates fatally in a very few days, with all the marks of a supervening gangrene. When the febrile state is more moderate, or disappears altogether, the disease is often protracted for weeks, and even for months; but, even then, after a various duration, it often terminates fatally, and generally in consequence of a return and considerable aggravation of the inflammatory and putrid states. In some cases, the disease ceases spontaneously; the frequency of stools, the griping, and tenesmus, gradually diminishing, while natural stools return. In other cases, the disease, with moderate symptoms, continues long, and ends in a diarrhœa, sometimes accompanied with lienteric symptoms.

Causes, &c. The remote causes of this disease have been variously judged of. It generally arises in summer or autumn, after considerable heats have prevailed for some time, and especially after very warm and at the same time very dry states of the weather; and the disease is much more frequent in warm than in cooler climates. It happens, therefore, in the same circumstances and seasons which considerably affect the state of the bile in the human body: but the cholera is often without any dysenteric symptoms, and copious discharges of bile have been found to relieve the symptoms of dysentery; so that it is difficult to determine what connection the disease has with the state of the bile.

It has been observed, that the effluvia from very putrid animal-substances readily affect the alimentary canal, and, upon occasion, they certainly produce a diarrhœa; but whether they ever produce a genuine dysentery, is not certain.

The dysentery does often manifestly arise from the application of cold, but the disease is always contagious; and, by the propagation of such contagion, independent of cold, or other exciting causes, it becomes epidemic in camps and other places. It is, therefore, to be doubted if the application of cold ever produces the disease, unless where the specific contagion has been previously received into the body; and, upon the whole, it is probable that a specific contagion is to be considered as being always the remote cause of this disease.

Whether this contagion, like many others, be of a permanent nature, and only shows its effects in certain circumstances which render it active, or if it be occasionally produced, we cannot determine. Neither, if the latter supposition be received, can we say by what means it may be generated. As little do we know any thing of its nature, considered in itself; or at most, only this, that, in common with many other contagions, it is very often somewhat of a putrid nature, and capable of inducing a putrescent tendency in the human body. This, however, does not at all explain the peculiar effect of inducing those symptoms which properly and essentially constitute dysentery. Of these symptoms the proximate cause is still obscure.—

The

Profluvia the common opinion has been, that the disease depends upon an acrid matter thrown upon or somehow generated in the intestines, exciting their peristaltic motion, and thereby producing the frequent stools which occur in this disease. But this supposition cannot be adopted; for, in all the instances known, of acrid substances applied to the intestines, and producing frequent stools, they at the same time produce copious stools, as might be expected from acrid substances applied to any length of the intestines. This, however, is not the case in a dysentry, in which the stools, however frequent, are generally in very small quantity, and such as may be supposed to proceed from the lower parts of the rectum only. With respect to the superior portions of the intestines, and particularly those of the colon, it is probable they are under a preternatural and considerable degree of constriction; for, as we have said above, the natural fæces are seldom voided; and when they are, it is in a form which gives reason to suppose they have been long retained in the cells of the colon, and consequently that the colon had been affected with a preternatural constriction. This is confirmed by almost all the dissections which have been made of the bodies of dysenteric patients; in which, when gangrene had not entirely destroyed the texture and form of the parts, large portions of the great guts have been found affected with a very considerable constriction.

The proximate cause of dysentery, or at least the chief part of the proximate cause, seems to consist in a preternatural constriction of the colon, occasioning at the same time, those spasmodic efforts which are felt in severe gripings, and which efforts propagated downwards to the rectum, occasion there the frequent mucous stools and tenesmus. But whether this explanation shall be admitted or not, it will still remain certain, that hardened fæces, retained in the colon, are the cause of the griping, frequent stools, and tenesmus; for the evacuation of these fæces, whether by nature or by art, gives relief from the symptoms mentioned; and it will be more fully and usefully confirmed by this, that the most immediate and successful cure of dysentery is obtained by an early and constant attention to the preventing the constriction, and the frequent stagnation of fæces in the colon.

Cure. In the early periods of this disease, the objects chiefly to be aimed at are the following: The discharge of acrid matter deposited in the alimentary canal; the counteracting the influence of this matter, when it cannot be evacuated; the obviating the effects resulting from such acrid matter as can neither be evacuated nor destroyed; and, finally, the prevention of any further separation and deposition of such matter in the alimentary canal. In the more advanced periods of the disease, the principal objects are, the giving a proper defence to the intestines against irritating causes; the diminution of morbid sensibility of the intestinal canal; and the restoration of due vigour to the system in general, but to the intestines in particular.

The most eminent of our late practitioners, and of greatest experience in this disease, seem to be of opinion, that it is to be cured most effectually by purging, assiduously employed. The means may be various; but the most gentle laxatives are usually sufficient; and, as the medicine must be frequently repeated, these are the most safe, more especially as an inflammatory state so frequently accompanies the disease. Whatever laxatives produce an evacuation of natural fæces, and a consequent remission of the symptoms, will be sufficient to effectuate the cure. But if the gentle laxatives shall not produce the evacuation now mentioned, somewhat more powerful must be employed; and Dr Cullen has found nothing more proper or convenient than tartar emetic, given in small doses, and at such intervals as may determine its operation to be chiefly by stool. To the antimonial tartar, however, employed as a purgative, the great sickness which it is apt to occasion, and the tendency which it has, notwithstanding every precaution, to operate as an emetic, are certainly objections. Another antimonial, at one time considered as an almost infallible remedy for this disease, the vitrum antimonii ceratum, is no less exceptionable, from the uncertainty and violence of its operation; and perhaps the safest and best purgatives are the different neutral salts, particularly those containing fossile alkali, such as the soda vitriolata tartarisata or phosphorata. Rhubarb, so frequently employed, is, he thinks, in several respects, amongst the most unfit purgatives; and indeed from its astringent quality, it is exceptionable at the commencement of the affection, unless it be conjoined with something to render its operation more brisk, such as mild muriated mercury, or calomel as it is commonly called.

Vomiting has been held a principal remedy in this disease; and may be usefully employed in the beginning, with a view to both the state of the stomach and of the fever; but it is not necessary to repeat it often; and, unless the emetics employed, operate also by stool, they are of little service. Ipecacuanha is by no means a specific; and it proves only useful when so managed as to operate chiefly by stool.

For relieving the constriction of the colon, and evacuating the retained fæces, glysters may sometimes be useful; but they are seldom so effectual as laxatives given by the mouth; and acrid glysters, if they be not effectual in evacuating the colon, may prove hurtful by stimulating the rectum too much.

The frequent and severe griping attending this disease, leads almost necessarily to the use of opiates; and they are very effectual for the purpose of relieving from the gripes: but, by occasioning an interuption of the action of the small intestines, they favour the constriction of the colon, and thereby aggravate the disease; and if, at the same time, the use of them supersede in any measure the employing purgatives, it is doing much mischief; and the neglect of purging seems to be the only thing which renders the use of opiates very necessary.

When the gripes are both frequent and severe, they may sometimes be relieved by the employment of the semicupium, or by fomentation of the abdomen continued for some time. In the same case, the pains may be relieved, and the constriction of the colon may be taken off, by blisters applied to the lower belly.

At the beginning of this disease, when the fever is any way considerable, blood-letting, in patients of tolerable

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tolerable vigour, may be proper and necessary; and, when the pulse is full and hard, with other symptoms of an inflammatory disposition, blood-letting ought to be repeated. But, as the fever attending dysentery is often of the typhoid kind, or does, in the course of the disease, become soon of that nature, blood-letting must be cautiously employed.

From our account of the nature of this disease, it will be sufficiently obvious, that the use of astringents in the beginning of it must be very pernicious. But although astringents may be hurtful at early periods of this affection, yet it cannot be denied that where frequent loose stools remain after the febrile symptoms have subsided, they are often of great service for diminishing morbid sensibility, and restoring due vigour to the intestinal canal. Accordingly, on this ground a variety of articles have been highly celebrated in this affection; among others we may mention the quassia, radix indica lopeziana, verbascum, extractum catechu, and gum kino, all of which have certainly in particular cases been employed with great advantage. And perhaps also, on the same principles, we are to account for the benefit which has been sometimes derived from the nux vomica, a remedy highly extolled in cases of dysentery by some of the Swedish physicians; but this article, it must be allowed, often proves very powerful as an evacuant. Its effects, however, whatever its mode of operation may be, are too precarious to allow its ever being introduced into common practice; and in Britain, it has, we believe, been but very rarely employed. Whether an acrid matter be the original cause of the dysentery, may be uncertain; but, from the indigestion, and the stagnation of fluids, which attend the disease, we may suppose that some acrid matters are constantly present in the stomach and intestines; and therefore that demulcents may be always usefully employed. At the same time, from the consideration that mild oily matters thrown into the intestines in considerable quantity always prove laxative, Dr Cullen is of opinion, that the oleaginous demulcents are the most useful. Where, however, these are not acceptable to the patient's taste, those of the mucilaginous and farinaceous kind, as the decoctum hordei, potio cretacea, &c. are often employed with advantage.

As this disease is so often of an inflammatory or of a putrid nature, it is evident that the diet employed in it should be vegetable and acescent. Milk, in its entire state, is of doubtful quality in many cases; but even some portion of the cream is often allowable, and whey is always proper.—In the first stages of the disease, the sweet and subacid fruits are allowable, and even proper. It is in the more advanced stages only that any morbid acidity seems to prevail in the stomach, and to require some reserve in the use of acescents. At the beginning of the disease, absorbents seem to be superfluous; and by their astringent and septic powers, they may be hurtful; but in after periods they are often of advantage.

When this disease is complicated with an intermittent, and is protracted from that circumstance chiefly, it is to be treated as an intermittent, by administering the Peruvian bark, which in the earlier periods of the disease is hardly to be admitted.

Apoplexia.

Class II. NEUROSES.

Order I. COMATA.

Comata, *Sauv.* Class VI. Ord. II. *Sag.* Class IX. Ord. V.
Soporosi, *Lin.* Class VI. Ord. II.
Adynamiæ, *Vog.* Class VI.
Nervorum resolutiones, *Hoffm.* III. 194.
Affectus soporosi, *Hoffm.* III. 209.
Motuum vitalium defectus, *Junck.* 114.

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Apoplexia, *Sauv.* gen. 182. *Lin.* 101. *Vog.* 229. *Boerh.* 1007. *Junck* 117. *Sag.* gen. 288. *Wepfer*, Hist. apoplecticorum.
Carus *Sauv.* gen. 181. *Lin.* 100. *Vog.* 231. *Boerh.* 1045. *Sag.* gen. 287.
Cataphora, *Sauv.* gen. 180. *Lin.* 99. *Vog.* 232. *Boerh.* 1048. *Sag.* gen. 286.
Coma, *Vog.* 232. *Boerh.* 1048.
Hæmorrhagia cerebri, *Hoffm.* II. 240.

To this genus also Dr Cullen reckons the following diseases to belong.

Catalepsis, *Sauv.* gen. 176. *Lin.* 129. *Vog.* 230. *Sag.* gen. 281. *Boerh.* 1036. *Junck.* 44.
Affectus cerebri spasmodico-ecstaticus, *Hoffm.* III. 44.
Ecstasis, *Sauv.* gen. 177. *Vog.* 333. *Sag.* gen. 283.

The following he reckons symptomatic.

Typhomania, *Sauv.* gen. 178. *Lin.* 97. *Vog.* 23. *Sag.* gen. 284.
Lethargus, *Sauv.* gen. 197. *Lin.* 98. *Vog.* 22. *Sag.* gen. 285.

This disease appears under modifications so various, as to require some observations with respect to each.

Sp. I. The *Sanguineous Apoplexy* 256

Description. In this disease the patients fall suddenly down, and are deprived of all sense and voluntary motion, but without convulsions. A giddiness of the head, noise in the ears, corruscations before the eyes, and redness of the face, usually precede. The distinguishing symptom of the disease is a deep sleep, attended with violent snorting; if any thing be put into the mouth, it is returned through the nose; nor can any thing be swallowed without shutting the nostrils; and even when this is done, the person is in the utmost danger of suffocation. Sometimes apoplectic patients will open their eyes after having taken a large dose of an emetic; but if they show no sign of sense, there is not the least hope of their recovery. Sometimes the apoplexy terminates in an hemiplegia; in which case it comes on with a distortion of the mouth towards the sound side, a drawing of the tongue the same way, and stammering of the speech. Dissections sometimes show a rupture of some vessels of the meninges, or even vessels of the brain itself; though sometimes, if we may believe Dr Willis, no defect

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Causes, &c. The general cause of a sanguineous apoplexy is a plethoric habit of body, with a determination to the head. The disease therefore may be brought on by whatever violently urges on the circulation of the blood; such as surfeits, intoxication, violent passions of the mind, immoderate exercise, &c. It takes place, however, for the most part, when the venous plethora has subsisted for a considerable time in the system. For that reason it commonly does not attack people till past the age of 60; and that whether the patients are corpulent and have a short neck, or whether they are of a lean habit of body. Till people be past the age of childhood, apoplexy never happens.

Prognosis. This disease very often kills at its first attack; and few survive a repetition of the fit; so that those who make mention of people who have survived several attacks of the apoplexy, have probably mistaken the epilepsy for this disease. In no disease is the prognosis more fatal; since those who seem to be recovering from a fit, are frequently and suddenly carried off by its return, without either warning of its approach or possibility of preventing it. The good signs are when the disease apparently wears off, and the patient evidently begins to recover; the bad ones are when all the symptoms continue and increase.

Cure. The great object to be aimed at, is to restore the connection between the sentient and corporeal parts of the system; and when interruption to this connection proceeds from compression in the brain by blood, this is to be attempted, in the first place, by large and repeated bleedings; after which, the same remedies are to be used as in the serous apoplexy, aftermentioned. The body is to be kept in a somewhat erect posture, and the head supported in that situation.

257 Sp. II. The *Serous Apoplexy*.

Apoplexia pituitosa, *Sauv.* sp. 7. Apoplexia serosa, *Preysinger*, sp. 4. *Morg.* de causis, &c. IV. LX.
Carus a hydrocephalo, *Sauv.* sp. 16.
Cataphora hydrocephalica, *Sauv.* sp. 6.
Cataphora somnolenta, *Sauv.* sp. 1.
Lethargus literatorum, *Sauv.* 7. *Van Swieten* in Aphor. 1010. 2 γ and 3 α.

Description. In this species the pulse is weak, the face pale, and there is a diminution of the natural heat. On dissection, the ventricles of the brain are found to contain a larger quantity of fluid than they ought; the other symptoms are the same as in the former.

Causes, &c. This may arise from any thing which induces a debilitated state of the body, such as depressing passions of the mind, much study, watching, &c. It may also be brought on by a too plentiful use of diluting, acidulated drinks. It doth not, however, follow, that the extravasated serum above mentioned in the ventricles of the brain is always the cause of the disease, since the animal-humours are very frequently observed to ooze out in plenty through the coats of the containing vessels after death, through no extravasation took place during life.

Prognosis. This species is equally fatal with the other; and what hath been said of the prognosis of the sanguineous, may also be said of that of the serous, apoplexy. Apoplexia.

Cure. In this species venesection can scarcely be admitted: acrid purgatives, emetics, and stimulating clysters, are recommended to carry off the supperabundant serum; but in bodies already debilitated, they may perhaps be liable to the same exceptions with venesection itself. Volatile salts, cephalic elixirs, and cordials, are also perscribed; and in case of a hemiplegia supervening, the cure is to be attempted by aperient ptisans, cathartics, and sudorifics; gentle exercise, as riding in a carriage; with blisters and such stimulating medicines as are in general had recourse to in affections originally of the paralytic kind.

Sp. III. *Hydrocephalic Apoplexy*, or *Dropsy* of the *Brain*. 258

Hydrocephalus interior, *Sauv.* sp. 1.
Hydrocephalus internus, *Whytt's* works, pag. 725. London Med. Obs. vol. iv. art. 3, 6, and 25. *Gaudelius* de hydrocephalo, apud *Sandifort* Thesaur. vol. ii.
Hydrocephalus acutus, *Quin*, *Diss.* de hydrocephalo, 1779.
Asthenia a hydrocephalo, *Sauv.* sp. 3.

History and description. This disease has been accurately treated within these few years by several eminent physicians, particularly the late Dr Whytt, Dr Fothergill, and Dr Watson; who concur in opinion with respect to the seat of the complaint, the most of its symptoms, and its general fatality. Out of twenty patients that had fallen under Dr Whytt's observation, he candidly owns that he had been so unfortunate as to cure only one who laboured under the characteristic symptoms of the hydrocephalus; and he suspects that those who imagine they have been more successful, had mistaken another distemper for this. It is by all supposed to consist in a dropsy of the ventricles of the brain; and this opinion is fully established by dissections, it is observed to happen more commonly to healthy, active, lively children, than to those of a different disposition.

Dr Whytt supposes that the commencement of this disease is obscure; that it is generally some months in forming; and that, after some obvious urgent symptoms rendering assistance necessary, it continues some weeks before its fatal termination. This, in general, differs from what has hitherto been observed by Dr Fothergill, the latter informing us, that he has seen children, who, from all appearence, were healthy and active, seized with this distemper, and carried off in about 14 days. He has seldom been able to trace the commencement of it above three weeks.

Though the hydrocephalus be most incident to children, it has been sometimes observed in adults; as appears from a case related by Dr Huck, and from some others.

When the disease appears under its most common form, the symptoms at different periods are so various as to lead Dr Whytt to divide the disease into three stages, which are chiefly marked by changes occuring in the condition of the pulse. At the beginning it is quicker

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quicker than natural; afterwards it becomes uncommonly slow; and towards the conclusion of the disease it becomes again quicker than natural, but at the same time very irregular.

Those who are seized with this distemper usually complain first of a pain in some part below the head; most commonly about the nape of the neck and shoulders; often in the legs; and sometimes, but more rarely, in the arms. The pain is not uniformly acute, nor always fixed to one place; and sometimes does not affect the limbs. In the latter case, the head and stomach have been found to be most disordered; so that when the pain occupied the limbs, the sickness or head-ach was less considerable; and when the head became the seat of the complaint, the pain in the limbs was seldom or never mentioned. Some had very violent sicknesses and violent head-achs alternately. From being perfectly well and sportive; some were in a few hours seized with those pains in the limbs, or with sickness, or head-ach, in a slight degree, commonly after dinner; but some were observed to droop a few days before they complained of any local indisposition. In this manner they continued three, four, or five days more or less, as the children were healthy and vigorous. They then commonly complain of an acute deep-seated pain in the head, extending across the forehead from temple to temple; of which, and a sickness they alternately complain in short and affecting exclamations; dosing a little in the intervals, breathing irregularly, and sighing much while awake. Sometimes their sighs, for the space of a few minutes, are incessant.

As the disease advances, the pulse becomes slower and irregular, the strokes being made both with unequal force and in unequal times, till within a day or two of the fatal termination of the disorder, when it becomes exceeding quick; the breathing being at the same time deep, irregular, and laborious. After the first access, which is often attended with feverish heats especially towards evening, the heat of the body is for the most part temperate, till at last it keeps pace with the increasing quickness of the pulse. The head and præcordia are always hot from the first attack. The sleeps are short and disturbed, sometimes interupted by watchfulness; besides which there are startings.

In the first stage of the disease there seems to be a peculiar sensibility of the eyes, as appears from the intolerance of light. But in the progress of the disease a very opposite state occurs: The pupil is remarkably dilated, and cannot be made to contract by the action even of strong light; such, for example as by bringing a candle very near to it. In many cases there is reason to believe that total blindness occurs: Often also the pupil of one eye is more dilated than that of another, and the power of moving the eyes is also morbidly affected. Those children, who were never observed to squint before, often become affected with a very great degree of strabismus. The patients are unwilling to be disturbed for any purpose, and can bear no posture but that of lying horizontally. One or both hands are most commonly about their heads. The urine and stools come away insensibly. At length the eyelids become paralytic, great heat accompanied with sweat overspreads the whole body, respiration is rendered totally suspirious, the pulse increases in its trembling indulations beyond the possibility of counting; till the vital motions entirely cease; and sometimes convulsions conclude the scene.

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Many of the symptoms above enumerated are so common to worm-cases, teething, and other irritating causes, that it is difficult to fix upon any which particularly characterise this disease. The most peculiar seem to be the pains in the limbs, with sickness and incessant head-ach; which, though frequent in other diseases of children, are neither so uniformly nor so constantly attendant as in this. Another circumstance observed to be familiar, if not peculiar to this distemper, is, that the patients are not only costive, but it is likewise with the greatest difficulty that stools can be procured. These are generally of a very dark greenish colour with an oiliness or a glassy bile, rather than the slime which accompanies worms; and they are, for the most part extremely offensive. No positive conclusion can be drawn from the appearance of the urine; it being various, in different subjects, both in its colour and contents, according to the quantity of liquor they drink, and the time between the discharges of the urine. From their unwilingness to be moved, they often retain their water 12 or 15 hours, and sometimes longer. In complaints arising from worms, and in dentition, convulsions are more frequent than in this disorder. Children subject to fits are sometimes seized with them a few days before they die. Sometimes these contine 24 hours incessantly, and till they expire.

Causes. The causes of internal hydrocephalus are very much unknown. Some suppose it to proceed from a rupture of some of the lymphatic vessels of the brain. But this supposition is so far from being confirmed by any anatomical observation, that even the existence of such vessels in the brain is not clearly demonstrated. That lymphatics, however, do exist in the brain, cannot be doubted; and one of the most probable causes giving rise to an accumulation of water in the brain is a diminished action of these. Here, however, as well as in other places, accumulation may also be the consequence of augmented effusion; and in this way, an inflammatory disposition, as some have supposed, may give rise to the affection, But from whatever cause an accumulation of water in the ventricles of the brain may be produced, there can be no doubt that from this the principal symptoms of the disease arise, and that a cure is to be accomplished only by the removal of it. It is, however, probable, that the symptoms are somewhat varied by the position of the water, and that the affection of vision in particular is often the consequence of some morbid state about the *thalami nervorum opticorum;* at least, in many cases, large collections of water in the ventricles have occurred, without either strabismus, intolerance of light, or dilatation of the pupil. And in cases where these symptoms have taken place to a remarkable degree, while upon dissection after death but a very small collection of water was found in the ventricles, it has been observed that a peculiar tumid appearance was discovered about the optic nerves, which upon examination was found to arise from water in the cellular texture. This may have given compression producing a state of insensibility; but it may have been preceded, or it may even have originated from, some inflammatory af-

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fection of these parts producing the intolerance of light.

Prognosis and Cure. Till very lately this disorder was reckoned totally incurable; but of late it has been alleged, that mercury if applied in time, will remove every symptom. This remedy was first thought of by Dr Dobson of Liverpool, and afterwards employed apparently with success by Dr Percival and others. The method of exhibiting this medicine in order to effect a cure, as well as the inutility of other medicines, will fully appear from the following cases.

CASE I. By Dr PERCIVAL.

"September 4. 1777. Master H. a child at the breast, aged seven months, has laboured about a fortnight under a slow irregular fever. His eyes have been now and then a little distorted; he has been affected wirh some degree of stupor; his gums have been inflamed and tender; and his mouth uncommonly dry. No tooth has yet made its appearance. An emetic has been administered; a blister applied to his back; and his belly has been kept soluble by repeated small doses of magnesia. During the action of the blister, he was thought to be much better, but he soon relapsed into his former state.

"About three o'clock this morning he was convulsed: at nine I saw him; and from his countenance instantly suspected a dropsy of the brain. The symptoms coufirmed my aprehensions. His skin was hot; yet his pulse beat only 78 strokes in a minute, which were irregular. The pupils ef his eyes were considerably, but unequally, dilated; nor did they contract much when a lighted candle was suddenly held before them. He often squinted, especially with the right eye, and seemed to take no notice of any objects around him. He refused the breast, and seldom swallowed till the lips and tongue had been stimulated with a feather. During several days past, he had been frequently observed to rub the end of his nose when his hand was at liberty; and notwithstanding his stupor, he had been uncommonly watchful. I examined his head and found a manifest tumor of the bregma, which had never before been noticed. Convinced by all these circumstances that the child laboured under the hydrocephalus internus, and that he was now in the second stage of that disorder, I directed ten grains of the *unguentum mercuriale mitius* to be rubbed into his thighs every three hours, till the mouth should be affected, and a tea-spoonful of the following mixture to be given whenever the convulsive symptoms recurred.

R. *Salis ammon. vol.* ℈i. *Succi Lemon.* ʒvi. *Mosch. opt. mucilagine gum. Arabic. solut.* gr. vi. *Sacch. alb.* q. s. *adgratium. M.*

"Small blisters were applied on each side of the head, just below the bregma; and a folded rag, frequently moistened with brandy, was laid upon the tumor to promote absorption. An emetic had been given early in the morning, by which a large quantity of bile was discharged; and a vesicatory had also been applied to his leg.

"September 5. nine o'clock. The child has had frequent convulsions in the night; his right eye is much distorted; and it has been remarked, that he seldom moves the right hand. The pulse beat 120 strokes in a minute. Two scruples of the mercurial ointment have been used, and he has taken five grains of musk. A large discharge of serum has been produced by the blisters. Five o'clock, P. M. the tumor of the head is sensibly diminished; the child's mouth is now moist, and often filled with saliva; and his tongue appears to be swolen. His pulse beat 146 strokes in a minute, I directed another blister to be applied to the head.

"September 6. His convulsions have been much slighter; his eyes are frequently distorted; and the pupils of each are more contracted. The stupor is considerably abated; the child seems to take some notice, distinguishes taste, and swallows freely. The musk has been continued; and half a dram more of the mercurial ointment has been consumed. A clyster was injected last night. but ineffectually: I therefore prescribed a grain of jalap, mixed with an equal quantity of sugar, to be given every three hours, till a motion to stool succeeded.

"September 7. The child has passed the night more comfortably, but not free from convulsions. His head has sweated profusely, and the blisters have run much. The tumor of the bregma is considerably reduced. The jalap operated gently last night, and the mercurial unction has been twice repeated. There is an evident mitigation of all the symptoms.

"September 8. About eleven o'clock last night the child was attacked with severe convulsions, which recurred frequently till six o'clock this morning. He has had a short sleep, and is now composed. His pulse beats 140 strokes in a minute, his heat is moderate; and his skin soft and perspirable. The mercurial ointment has been again used; but, though his gums and tongue are sore and very moist, his breath is not offensive. I directed a grain of calomel to be immediately given, to procure a stool; and a blister to be applied to the occiput,

"September 10, He has passed two nights almost entirely free from convulsions. Ten grains of the mercurial ointment have been again rubbed into his thighs. The dose of calomel occasioned three very offensive stools; and directions are given to repeat it, as he is again costive. The blister aplied to the occiput, like, the others, has produced a very copious discharge. The tumor of the head is now scarcely perceptible. Pulse 120.

"September 12 At 12. o'clock last night, the convulsions recurred with greater violence than ever, and still continne. Two teeth have almost protruded through the upper, and the same number through the lower gum. Pulse 160, tremulous, and irregulur. I directed that the child should be immediately put into a warm bath, and that the following remedies should be administered.

℞ *Infus. rad. valer. fortissimi* ℥ii.
Asafætid. electæ ℈ß. *M.* f. *Enema statim injiciendum.*
℞ *Tinct. valer. volat.* ʒii. *Dentur guttæ* jii, *Subinde e cochleari parvulo infusi rad. valer. sylv. sub forma theæ parati.*

"The convulsions continued but with less violence; and the child expired about one o'clock in the afternoon."

On this case the Doctor makes the following observations.

"The deplorable case which I have related appears

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pears to have originated from the irregular action produced in the ſyſtem by dentition, and from the want of a due ſecretion of ſaliva in the mouth, by which the fluid diſcharges were probably increaſed in the ventricles of the brain. That theſe diſcharges were diminiſhed, and that the extravaſated water was abſorbed, by the powerful action of the mercury, may be preſumed from the mitigation of all the ſymptoms which ſucceeded the ſalivation. And I am inclined to believe, that the convulſions under which the child expired were more owing to the irritation of his gums by the protruſion of four teeth, than to any remaining water in the brain; for the tumor of the head had entirely diſappeared, and after death there was a manifeſt depreſſion of the bregma. During the ſpace of a week, 110 grains of the unguentum mercuriale mitius, which contains about 22 grains of mercury, was conſumed in the uſual way of friction. Perhaps half of this quantity might be abſorbed, and carried into the courſe of circulation; to which may be be added, part of the two grains of the calomel adminiſtered internally. The ſymptoms of the ſalivation were not violent; and the effects of the mercury did not appear formidable or alarming, even to the parents of the child, who were appriſed of the nature of the diſorder, and fully approved of the trial of this new method of treating it."

Case II. By Dr Dobson

"On the 13th of February 1775, I was called to the only ſon of Mr C. a gentleman of this place: the child was between three and four years of age; had been indiſpoſed about eight days; and had frequently complained of pain in his head and wearineſs, and pains in his limbs: had been ſick by fits, and ſometimes vomited; was feveriſh, and could not bear the light.

"I was much alarmed on hearing this account, as the *hydrocephalus internus* had already proved fatal to three children of this family, who had all been under my care. And that this had been the diſeaſe was evident, both from the ſymptoms and the appearances on diſſection. But my alarm was much farther increaſed on examining the little patient. The pulſe I found very frequent and irregular. The head hot, the cheeks fluſhed; the pupils dilated, and a great degree of ſtrabiſmus. There remained no doubt with reſpect to the nature of the diſeaſe.

"An emetic, ſome calomel powders, and a purgative, had been adminiſtered, without affording any relief. I directed the pediluvium, and emetic tartar, to be given in ſuch doſes as to excite nauſea.

"February 14th. The ſymytoms the ſame, with frequent ſtartings, diſturbed ſleep, and toſſing from ſide to ſide on the pillow. A bliſter was applied between the ſhoulders, the pediluvium repeated, and the emetic tartar continued.

"15th. Comatoſe, reſtleſs, and ſhrieking by fits. The pulſe ſlower than in health, and the eyes inſenſible even to the impreſſions of ſtrong light.

"As I had no hope of doing any thing effectual for the recovery of my patient, I paid my viſits, preſcribed, and gave directions with a foreboding and heavy heart. Anxiouſly, however, conſidering the caſe in different points of view, and fully convinced that it was vain to purſue the uſual line of practice, it occurred to me, that mercurials, ſo far urged as to enter the courſe of circulation, and affect the ſalivary glands, might poſſibly reach the ſyſtem of abſorbents in the ventricles of the brain, and thus remove the extravaſated fluid.

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"The ſhort continuance of the diſeaſe, and the apparent ſtrength of my patient, were favourable to the trial of this method. No time, however, was to be loſt. The parents were conſulted, and readily gave their ſanction to the propoſal; for they were convinced, that, unleſs ſome powerful ſteps were taken, this their only ſon muſt be numbered with thoſe of their children who had already fallen a ſacrifice to the diſeaſe.

"The mercurial courſe, therefore, was commenced, and urged on with caution and expedition. In 48 hours the breath began to be offenſive; the gums were reddiſh and ſwelled; and the ſymptoms of the diſeaſe, ſo far as could be diſtingniſhed, were ſomewhat abated. In 48 hours more the ptyaliſm came on, and the diſeaſe was evidently declining. Between the 15th and 22d he took 20 grains of calomel, and one drachm of the ſtrongeſt mercurial ointment was likewiſe rubbed in well upon the legs and thighs. The doſe of calomel was one grain, mixed with a little ſugar, and repeated at ſuch intervals as the circumſtances of the caſe pointed out.

"After the 22d no more mercurials were adminiſtered: a moderate ptyaliſm continued for five or ſix days, then gradually ceaſed, and the diſeaſe was entirely removed. The bark was then given, as the beſt tonic remedy after the mercurial courſe, and as the beſt preſervative againſt a relapſe. The ſtrabiſmus, I obſerved, was the laſt ſymptom which diſappeared.

"From the 15th, no other medicines were uſed except mercurials. The three ſiſters of the above patient, who all died of this diſeaſe, were treated with bliſters; and to one of them they were applied in ſucceſſion to the head, behind the ears, and between the ſhoulders."

Case IIIi By Dr Percival.

"One of my own children, a girl, aged three years and three months, has lately been a ſevere ſufferer under this alarming malady. As ſoon as the characteriſtic ſymptoms of the diſeaſe clearly manifeſted themſelves, I laid aſide all other remedies, convinced, by repeated obſervation, of their inſufficiency; and truſted ſolely, though with much ſolicitude, to the internal and external uſe of mercury. In 48 hours, ſigns of amendment appeared, and her recovery was perfected in ſix days. During this ſpace of time, thirteen grains of calomel were adminiſtered, and ſeven ſcruples of *unguentum mercuriale fortius* carefully rubbed into her legs."

Case IV. By Mr John Mackie Surgeon in Huntington.

John Algood, aged 27, of a thin habit of body, accuſtomed for four or five years paſt to work in a tan-yard in a very ſtooping poſture, was attacked in the beginning of May with an irregular intermitting fever, accompanied with much pain in his joints.

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These complaints continued till about the middle of June, when he was seized with a violent and constant pain in the back-part of his head, attended with great giddiness, noise in his head and ears, dimness of sight, &c. and his fever became more continued. He lay in this state upwards of a month, without receiving any benefit from some medicines which he took during this period.

Mr Mackie was called to him in the middle of July, and found him labouring under the following symptoms: A fixed pain on the right side and back part of his head, which was frequently so acute as to make him quite outrageous, crying out, tearing his hair, beating himself on the head, &c. He had such a giddiness, that, unless strongly held, he could not support himself a moment in an upright posture. He could not bear the light; and, when he did venture to open his eyes, could not see objects distinctly. His pupils were uncommonly dilated; and his right eye seemed drawn outward, and rather contracted in its volume. He complained of a strange palpitating noise in his head and ears; and said, he felt at times as if there was a weight of water falling from one side of his head to the other. He was, in general, sensible; but, on asking him two or three questions together, he became confused, and, like a person with an oppressed brain, answered with hesitation, quite wide of the question, and often opposite to what he meant. Along with these, he had a hot skin, small quick pulse, thirst, a foul tongue, urine in small quantity and high-coloured; he was emaciated, sick, costive, and sweated much; had often a kind of stupor, but very little sleep. Once in the 24 hours he had generally a remission (of three or four hours continuance) of the febrile symptoms, but of none of the other complaints.

July 16th. Ordered three or four leeches to be applied to each temple immediately; an emetic to be taken in the evening, and a cooling purge to-morrow morning.

17th. In the evening found the leeches had taken away a good deal of blood, and the vomit and purge operated well. No change in the complaints, except that the sickness is a little abated. He screamed greatly on attempting to raise his head from the pillow.

Ordered his head to be shaved, and a sharp blister to be applied all over the occiput, large enough to cover the nape of the neck; also one on the inside of the leg. Internally.—R. *Nitri puri*, dr. ss. *Camphoræ*, gr. iv. M. f. *pulvis; quarta quaque hora sumendus durante febrile calore.* R. *Pulv. cort. Peruvian.* dr. i. *Pulv. rad. valerian. sylv.* dr. ss. M. f. *pulvis, exhibendus quamprimum remissio appareat, & repetendus si ultra horas tres pergat.* Thin milk-gruel and barley-water for drink.

July 19th. The blisters have discharged much, and he has taken the medicines punctually; but the fever and other complaints remain as before. Pulse very irregular; pain in the head and restlessness extreme.

I left off the camphor; and in its stead added to each nitrous powder, tartar emetic, gr. $\frac{1}{4}$. Dressed the blisters with the *unguent. ad vesicatoria.*

21st. Two doses of the bark and valerian were given during the two last remissions of the fever, which were full four hours each; but to day there appears no kind of amendment. All the symptoms continue much the same. Shrieked out much, and talked incoherently. Has had no stool since he took his physic. Ordered a laxative glyster to be thrown up directly, and the medicines to be continued as on the 19th.

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23d. The glyster procured two motions. Has sweated profusely through the last 48 hours. Blisters have run freely. The two last diurnal remissions not quite so distinct. No abatement of the other complaints. The pain, giddiness, stupor, contortion of the eyes, &c. remain in as great a degree as ever.

Mr Mackie now left off all other medicines, and ordered ten grains of calomel, made into a bolus with conserve of roses, to be taken at bed-time: at the same time, a drachm of the strong mercurial ointment was directed to be rubbed into the ankles; and both to be repeated every night.

25th. Found no alteration. Fever and other symtoms the same. Blisters heal, having been dressed these two days with basilicon. The calomel, and mercurial friction, ordered to be continued as on the 23d.

26th. Mr Mackie found him complaining much of being griped. Had two purging stools in the last 24 hours. His gums were a little tender, and his breath beginning to be tainted. In other respects as usual. Left off the calomel, and ordered a double quantity of the mercurial ointment to be rubbed into his thighs every night.

28th. He had a calmer night than any for these two months past. For the first time, he said the pain of his head was abated; he looked more composed; his skin felt cooler; his pulse more full, and not so quick. He complained of his mouth being sore, and his tongue swelled; and had discharged a good deal of saliva in the night. Only one dram of the ointment to be rubbed in, for the two next nights.

30th. He spit about three quarts during the last 48 hours, and complains of much heat in his mouth; but all his other complaints better. Pain in his head almost gone, excepting now and then a shoot. Giddiness much abated. He said he often felt a trickling kind of motion, as of water running along the inside of his temples; but this sensation was without pain. He could sit up in bed, and feed himself; was sensible, and in spirits. Pulse regular, and not above 70 in a minute. He has had a remission of upwards of six hours to-day; ordered the ointment to be left off.

Aug. 1st. Continues to spit freely. Had yesterday a smart return of the fever; which, however, only held him about 12 hours. To-day there is a perfect remission, and he is in every respect much mended.—Has had some hours good sleep. Complains very little of pain. Got out of bed for the first time; sat up three hours; and could even bear the light without being disturbed by it. Complained of being hungry. Allowed plenty of milk-porridge and small broth.

3d. The spitting keeps up to about a quart in the 24 hours. Found him out of bed to-day, and almost without complaints. He said his head was well; and that he only wanted strength and to get rid of his fever and sore mouth. The remissions were now almost as long as the paroxysms, being about 12 hours each. Has taken no medicine internally since he left off the calomel,

Comata calomel, and was coſtive. Ordered a doſe of rhubarb; and after its operation a dram of the bark every four hours during the remiſſions.

6th The ſpitting begins to decline. He has had no fever for the laſt 24 hours. He ſleeps well; and has an appetite, if the ſoreneſs of his mouth would let him eat. Headach and giddineſs gone; but his pupils ſtill continue much dilated. Ordered him another rhubarb-purge, and the bark to be continued every ſix hours.

6th. Has had no fever, or other complaints. Spitting inconſiderable; mouth better; aſpect more natural; is able to walk about, and mends daily. Allowed him a more generous ond ſubſtantial diet, and continued the bark twice a-day for another week.

From this time, he continued to get ſtrength apace; had good nights, good appetite, a perfect freedom from head-ach and fever; and, on the 23d, went to work, being in every reſpect quite well, and has continued ſo ever ſince.

This patient did not ſeem to receive the ſmalleſt benefit from the bliſters, or any thing elſe, till he took the mercury, which acted like a ſpecific; and the fever ſeemed to be altogether ſymptomatic, as it eaſily yielded after the other complaints were removed.

Although it muſt be allowed, that the affection here deſcribed was in many reſpects an anomalous one, yet many of the circumſtances render it in ſome degree probable that it depended on water in the head; and there are ſtrong reaſons for inferring that the mercury puſhed ſo far as to excite ſalivation, was the means by which the cure was accompliſhed.

It is not wonderful that the publication of theſe caſes ſhould have led to the frequent employment of mercury in hydrocephalic affections. We are however, ſorry to add, that extenſive employment of this remedy in ſuch caſes has by no means confirmed the favourable opinion which ſome were diſpoſed to entertain of it. It has been found, that in many caſes where mercury with hydrocephalic patients had been employed both internally and externally to a very great extent, no ſalivation was produced. Some, therefore, have even gone ſo far as to conclude, that ſalivation cannot be induced in this diſeaſe; and there is little reaſon to doubt. that, in the advanced periods of the diſeaſe, there occurs both an inſenſibility and diminiſhed action of the abſorbents, by which alone mercury can be introduced into the ſyſtem; and likewiſe of the ſalivary organs, on which it muſt act before any obvious ſalivation can be induced. But, beſides that mercury is often given in this diſeaſe even to a great extent without producing any obvious effect, we muſt alſo mention with regret, that in not a few caſes of hydrocephalus, where mercury copiouſly exhibited at an early period produced ſalivation, the diſeaſe nevertheleſs has had a fatal termination, and it muſt be confeſſed, that an effectual remedy in this complaint ſtill remains to be diſcovered.

At the ſame time; beſides the caſes already mentioned, mercury has alſo ſucceeded in ſeveral others which had every appearance of hydrocephalus; and as we are yet unacquainted with any remedy, not even excepting bliſters, of which ſome are diſpoſed to think very favourably, on which more dependence is to be put, the careful and regular employment of it ſhould not be neglected in any inſtance of this affection, unleſs ſome circumſtance occur ſtrongly contraindicating its uſe.

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Sp. IV. Apoplexy *from Atrabilis.* 259

Apoplexia atrabiliaris, *Sauv.* ſp. 12. *Preyſinger.* ſp. 6.

This takes place in the laſt ſtage of the diffuſion of bile through the ſyſtem, i. e. of the black jaundice, and in ſome caſes the brain hath been found quite tinged brown. It cannot be thought to admit of any cure.

Sp. V. Apoplexy from *External Violence.* 260

Apoplexia traumatica, *Sauv.* ſp. 2.
Carus-traumaticus, *Sauv.* ſp. 5.

The treatment of this diſeaſe, as it ariſes from ſome external injury, properly falls under the article Surgery.

Sp. VI. Apoplexy *from Poiſons.* 261

Apoplexia temulenta, *Sauv.* ſp. 3.
Carus a narcoticis, *Sauv.* ſp. 14.
Lethargus a narcoticis, *Sauv.* ſp. 3.
Carus a plumbagine, *Sauv.* ſp. 10.
Apoplexia mephitica, *Sauv.* ſp. 14.
Aſphyxia a mephitide, *Sauv.* ſp. 9.
Aſphyia a muſto, *Sauv.* ſp. 3.
Catalepſis a fumo, *Sauv.* ſp. 3.
Aſphyxia a fumis, *Sauv.* ſp. 2.
Aſphyxia a carbonne, *Sauv.* ſp. 16.
Aſphyxia foricariorum, *Sauv.* ſp. 11.
Aſphyxia ſideratorum, *Sauv.* ſp. 10.
Carus ab inſolatione, *Sauv.* ſp. 12.
Carus a frigore, *Sauv.* ſp. 15.
Lethargus a frigore, *Sauv.* ſp. 6.
Aſphyxia congelatorum, *Sauv.* ſp. 5.

The poiſons which bring on an apoplexy when taken internally may be either of the ſtimulant or ſedative kind, as ſpirituous liquors, opium, and the more virulent kinds of vegetable poiſons. The vapours of mercury or of lead, in great quantity, will ſometimes produce a ſimilar effect; though commonly they produce rather a paralyſis, and operate ſlowly. The vapours of charcoal, or fixed air, in any form, breathed in great quantity, alſo produce an apoplexy, or a ſtate very ſimilar to it; and even cold itſelf produces a fatal ſleep, though without the apoplectic ſnorting.—To enumerate all the different ſymptoms which affect the unhappy perſons who have ſwallowed opium, or any of the ſtronger vegetable poiſons, is impoſſible, as they are ſcarce to be found the ſame in any two patients. The ſtate induced by them ſeems to differ ſomewhat from that of a true apoplexy; as it is commonly attended with convulſions, but has the particular diſtinguiſhing ſign of apoplexy, namely, a very difficult breathing or ſnorting, more or leſs violent according to the quantity of poiſonous matter ſwallowed.

Of the poiſonous effects fixed of air, Dr Percival gives the following account. "All theſe noxious vapours, whether ariſing from burning charcoal, the fermenting grape, the Grotti di Cani, or the cavern of Pyrmont, operate nearly in the ſame manner. When accumulated and confined, their effects are often inſtantaneous;

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ſtantaneous: they immediately deſtroy the action of the brain and nerves, and in a moment arreſt the vital motions. When more diffuſed, their effects are ſlower, but ſtill evidently mark out a direct affection of the nervous ſyſtem.

"Thoſe who are expoſed to the vapours of the fermenting grape, are as inſtantly deſtroyed as they would be by the ſtrongeſt electrical ſhock. A ſtate of inſenſibility is the immediate effect upon thoſe animals which are thruſt into the Grotti di Cani, or the cavern of Pyrmont: the animal is deprived of motion, lies as if dead; and if not quickly returned into the freſh air, is irrecoverable. And if we attend to the hiſtories of thoſe who have ſuffered from the vapours of burning charcoal, we ſhall in like manner find, that the brain and moving powers are the parts primarily affected.

"A cook who had been accuſtomed to make uſe of lighted charcoal more than his buſineſs required, and to ſtand with his head over theſe fires, complained for a year of very acute pain in the head; and after this, was ſeized with a paralytic affection of the lower limbs, and a ſlow fever.

"A perſon was left reading in bed with a pan of charcoal in a corner of the room. On being viſited early the next morning, he was found with his eyes ſhut, his book open and laid on one ſide, his candle extinguiſhed, and to appearance like one in a deep ſleep. Stimulants and cupping-glaſſes gave no relief; but he was ſoon recovered by the free acceſs of freſh air.

"Four priſoners, in order to make their eſcape, attempted to deſtroy the iron work of their windows, by the means of burning charcoal. As ſoon as they commenced their operations, the fumes of the charcoal being confined by the cloſeneſs of the priſon, one of them was ſtruck dead; another was found pale, ſpeechleſs, and without motion; afterwards he ſpoke incoherently, was ſeized with a fever, and died. The other two were with great difficulty recovered.

"Two boys went to warm themſelves in a ſtove heated with charcoal. In the morning they were found deſtitute of ſenſe and motion, with countenances as compoſed as in a placid ſleep. There were ſome remains of pulſe; but they died in a ſhort time.

"A fiſherman depoſited a large quantity of charcoal in a deep cellar. Some time afterwards, his ſon, a healthy ſtrong man, went down into the cellar with a pan of burning charcoal and a light in his hand. He had ſcarcely deſcended to the bottom, when his candle went out. He returned, lighted his candle, and again deſcended. Soon after, he called aloud for aſſiſtance. His mother, brother, and a ſervant, haſted to give him relief; but none of them returned. Two others of the village ſhared the ſame fate. It was then determined to throw large quantities of water into the cellar; and after two or three days, they had acceſs to the dead bodies.

"Cœlius Aurelianus ſays, that thoſe who are injured by the fumes of charcoal become cataleptic. And Hoffman enumerates a train of ſymptoms which in no reſpect correſpond with his idea of ſuffocation. Thoſe who ſuffer from the fumes of burning charcoal, ſays he, have ſevere pains in the head, great debility, faintneſs, ſtupor, and lethargy.

"It appears from the above hiſtories and obſervations, that theſe vapours exert their noxious effects on the brain and nerves. Sometimes they occaſion ſudden death; at other times, the various ſymptoms of a debilitated nervous ſyſtem, according as the poiſon is more or leſs concentrated. The olfactory nerves are firſt and principally affected, and the brain and nervous ſyſtem by ſympathy or conſent of parts. It is well known, that there is a ſtrong and ready conſent between the olfactory nerves and many other parts of the nervous ſyſtem. The effluvia of flowers and perfumes, in delicate or irritable habits, produce a train of ſymptoms, which, though tranſient, are analogous to thoſe which are produced by the vapours of charcoal; viz. vertigo, ſickneſs, faintneſs, and ſometimes a total inſenſibility. The female malefactor, whom Dr Mead inoculated by putting into the noſtrils doſſils of cotton impregnated with variolous matter, was, immediately on the introduction, afflicted with a moſt excruciating head-ach, and had a conſtant fever till after the eruption.

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"The vapours of burning charcoal, and other poiſonous effluvia, frequently produce their prejudicial, and even fatal effects, without being either offenſive to the ſmell or oppreſſive to the lungs. It is a matter of importance, therefore, that the common opinion ſhould be more agreeable to truth; for where ſuffocation is ſuppoſed to be the effect, there will be little apprehenſion of danger, ſo long as the breaſt keeps free from pain or oppreſſion.

"It may be well to remember, that the poiſon itſelf is diſtinct from that groſs matter which is offenſive to the ſmell; and that this is frequently in its moſt active ſtate when undiſtinguiſhed by the ſenſe. Were the following cautions generally attended to, they might in ſome inſtances be the happy means of preſerving life. Never to be confined with burning charcoal in a ſmall room, or where there is not a free draught of air by a chimney or ſome other way. Never to venture into any place in which air has been long pent up, or which from other circumſtances ought to be ſuſpected; unleſs ſuch ſuſpected place be either previouſly well ventilated, or put to the teſt of the lighted candle. For it is a ſingular and well-known fact, that the life of flame is in ſome circumſtances ſooner affected and more expeditiouſly extinguiſhed by noxious vapours than animal-life. A proof of which I remember to have received from a very intelligent clergyman, who was preſent at a muſical entertainment in the theatre at Oxford. The theatre was crowded; and during the entertainment, the candles were obſerved to burn dim, and ſome of them went out, The audience complained only of faintneſs and languor; but had the animal effluvia been ſtill further accumulated or longer confined, they would have been extinguiſhed as well as the candles.

"The moſt obvious, effectual and expeditious means of relief to thoſe who have unhappily ſuffered from this cauſe, are ſuch as will diſlodge and waſh away the poiſon, reſtore the energy of the brain and nerves, and renew the vital motions. Let the patient therefore be immediately carried into the open air, and let the air be fanned backwards and forwards to aſſiſt its action: let cold water be thrown on the face; let the face, mouth, and noſtrils, be repeatedly waſhed; and as ſoon

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as practicable, get the patient to drink ſome cold water. But if the ca e be too far gone to be thus relieved, let a healthy perſon breathe into the mouth of the patient; and gently force air into the mouth, throat, and noſtrils. Frictions, cupping, bleeding, and bliſters, are likewiſe indicated. And if, after the inſtant danger is removed, a fever be excited, the me. thod of cure muſt be adapted to the nature and prevailing ſymptoms of the fever."

With regard to the poiſon of opium, Dr Mead recommends the following method of cure. Beſides evacuations by vomiting, bleeding, and bliſtering, acid medicines and lixivial ſalts are proper. Theſe contract the relaxed fibres, and by their diuretic force make a depletion of the veſſels. Dr Mead ſays he hath given repeated doſes of a mixture of ſalt of wormwood and juice of lemons, with extraordinary ſucceſs. But nothing perhaps is of greater conſequence, than to uſe proper means for the prevention of ſleep, by rouſing and ſtiring the patient, and by forcing him to walk about; for if he be once permitted to fall into a ſound ſleep, it will be found altogether impoſſible to awake him.

Of a kind ſomewhat akin to the poiſon of opium ſeems to be that of laurel-water, a ſimple water diſtilled from the leaves of the lauro-ceraſus or common laurel. The bad effects of this were firſt obſerved in Ireland, where it had been cuſtomary to mix it with brandy for the ſake of the flavour; and thus two women were ſuddenly killed by it. This gave occaſion to ſome experiments upon dogs, in order to aſcertain the malignant qualities of the water in queſtion; and the event was as follows: All the dogs fell immediately into totterings and convulſions of the limbs, which were ſoon followed by a total paralyſis, ſo that no motion could be excited even by pricking or cutting them. No inflammation was found upon diſſection, in any of the internal membranes. The moſt remarkable thing was a great fulneſs and diſtenſion of the veins, in which the blood was ſo fluid, that even the lymph in its veſſels was generally found tinged with red. The ſame effects were produced by the water injected into the inteſtines by way of clyſter.

To make the experiment more fully, Dr Nicholls prepared ſome of this water ſo ſtrong, that about a drachm of heavy eſſential oil remained at the bottom of three pints of it, which by frequent ſhaking was again quite incorporated with it. So virulent was this water, that two ounces of it killed a middle-ſized dog in leſs than half a minute, even while it was paſſing down his throat. The poiſon appeared to reſide entirely in the abovementioned eſſential oil, which comes over by diſtillation, not only from the leaves of laurel, but from ſome other vegetables; for ten drops of a red oil diſtilled from bitter almonds, when mixed with half an ounce of water, and given to a dog, killed him in leſs than half an hour.

Volatile alkalies are found to be an antidote to this poiſon; of which Dr Mead gives the following inſtance. About an ounce of ſtrong laurel-water was given to a ſmall dog. He fell immediately into the moſt violent convulſions, which were ſoon followed by a total loſs of his limbs. When he ſeemed to be expiring, a vial of good ſpirit of ſal ammoniac was held to his noſe, and a ſmall quantity of the ſame forced down his throat: he inſtantly felt its virtue; and by continuing the uſe of it for ſome time, he by degrees recovered the motion of his legs; and in two hours walked about with tolerable ſtrength, and was afterwards quite well.

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With regard to the pernicious effects of cold, there is no other way of counteracting them but by the application of external heat. We are apt to imagine, that the ſwallowing conſiderable quantities of ardent ſpirits may be a means of making us reſiſt the cold, and preventing the bad effects of it from ariſing to ſuch an height as to deſtroy life; but theſe do not appear to be in the leaſt poſſeſſed of any ſuch virtue in thoſe countries liable to great exceſſes of cold. The Peruvian bark, by ſtrengthening the ſolids, as well is increaſing the motion of the fluids, is found to anſwer better than any other thing as a preſervative: but when the pernicious effects have already begun to diſcover themſelves, nothing but increaſing by ſome means or other the heat of the body can poſſibly be depended upon: and even this muſt be attempted with great care; for as, in ſuch caſes, there is generally a tendency to mortification in ſome of the extremities, the ſudden application of heat will certainly increaſe this tendency to ſuch a degree as to deſtroy the parts. But for the external treatment of ſuch mortifications, ſee the article SURGERY.

Sp. VII. APOPLEXY from *Paſſions* of the *Mind*. 262

Carus a pathemate, *Sauv.* ſp. 11.
Aſphyxia a pathemate, *Sauv.* ſp. 7.
Ecſtaſis catoche, *Sauv.* ſp. 1.
Ecſtaſis reſoluta, *Sauv.* ſp. 2.

APOPLEXIES from violent paſſions may be either ſanguineous or ſerous, though more commonly of the former than the latter ſpecies. The treatment is the ſame in either caſe. Or they may partake of the nature of catalepſy; in which caſe the method of treatment is the ſame with that of the genuine catalepſy.

Sp. VIII. The *Cataleptic* APOPLEXY. 263

Catalepſis, *Sauv*, gen. 176. *Lin.* 129. *Vog.* 230. *Sag.* gen. 281. *Boerh.* 1036. *Junck.* 44.

Dr CULLEN ſays he has never ſeen the catalepſy except when counterfeited; and is of opinion that many of thoſe caſes related by other authors have alſo been counterfeited. It is ſaid to come on ſuddenly, being only preceded by ſome languor of body and mind; and to return by paroxyſms. The patients are ſaid to be for ſome minutes, ſometimes (though rarely) for ſome hours, deprived of their ſenſes, and all power of voluntary motions; but conſtantly retaining the poſition in which they were firſt ſeized, whether lying or ſitting; and if the limbs be put into any other poſture during the fit, they will keep the poſture in which they are placed. When they recover from the paroxyſm, they remember nothing of what paſſed during the time of it, but are like perſons awaked out of ſleep.—Concerning the cure of this diſorder we find nothing that can be depended upon among medical writers.

Sp. IX. APOPLEXY from *Suffocation*. 264

Aſphyxia ſuſpenſorum, *Sauv.* ſp. 4.
Aſphyxia immerſorum, *Suv.* ſp, 1.

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This is the kind of apoplexy which takes place in those who are hanged or drowned. For the treatment of those persons, see the articles Drowning and Hanging.

Besides the species abovementioned, the apoplexy is a symptom in many other distempers, such as fevers both continued and intermitting, exanthemata, hysteria, epilepsy, gout, worms, ischuria, and scurvy.

265 Genus XLIII. PARALYSIS. The Palsy.

Paralysis, *Boerh.* 1057.
Hemiplegia, *Sauv.* gen. 170. *Lin.* 103. *Vog.* 220.
Paraplexia, *Sauv.* gen. 171.
Paraplegia, *Lin.* 102. *Vog.* 227.
Paralysis, *Sauv.* gen. 169. *Lin.* 104. *Vog.* 226. *Junck.* 115.
Atonia, *Lin.* 120.

266 Sp. I. The *Partial Palsy.*

Paralysis, *Sauv.* gen. 169. *Lin.* 104. *Vog.* 226. *Junck.* 115.
Paralysis plethorica, *Sauv.* sp. 1.
Paralysis serosa, *Sauv.* sp. 12.
Paralysis nervea, *Sauv.* sp. 11.
Mutitas a glossolysi, *Sauv.* sp. 1.
Aphonia paralytica, *Sauv.* sp. 8.

267 Sp. II. Hemiplegia, or *Palsy of one side of the* Body.

Hemiplegia, *Sauv.* gen. 170. *Lin.* 108. *Vog.* 228. *Sag.* gen. 276.
Hemiplegia ex apoplexia, *Sauv.* sp. 7.
Hemiplegia spasmodica, *Sauv.* sp. 2.
Hemiplegia serosa, *Sauv.* sp. 10.

268 Sp. III. Paraplegia, or *Palsy of one half* of the Body taken *transversely.*

Paraplexia, *Sauv.* gen. 171. *Sag.* gen. 277.
Paraplegia, *Lin.* 102. *Vog.* 227.
Paraplexia sanguinea, *Sauv.* sp. 2.
Paraplexia a spina bifida, *Sauv.* sp. 3.
Paraplexia rheumatica, *Sauv.* sp. 1.

Description. The palsy under all the different forms here mentioned as particular species, shows itself by a sudden loss of tone and vital power in a certain part of the body. In the slighter degrees of the disease, it only affects a particular muscle, as the sphincter of the anus or bladder, thus occasioning an involuntary discharge of excrements or of urine; of the muscles of the tongue, which occasions stammering, or loss of speech; of the muscles of the larynx, by which the patient becomes unable to swallow solids, and sometimes even liquids also.—In the higher degrees of the disease, the paralytic affection is diffused over a whole limb, as the foot, leg, hand, or arm; and sometimes it affects a whole side of the body, in which case it is called *hemiplegia;* and sometimes, which is the most violent case, it affects all the parts below the waste, or even below the head, though this last be exceedingly rare. In these violent cases, the speech is either very much impeded, or totally lost. Convulsions often take place in the sound side, with the cynic spasm or involuntary laughter, and other distortions of the face. Sometimes the whole paralytic part of the body becomes livid, or even mortifies before the patient's death; and sometimes the paralytic parts gradually decay and shrivel up, so as to become much less than before. Whether the disease be more or less extended, many different varieties may be observed in its form. Sometimes there occurs a total loss of sense while motion is entire; in others a total loss of motion with very slight or even no affection of sense; and in some cases, while a total loss of motion takes place in one side, a total loss of sense has been observed on the other. This depends entirely on the particular nerves or branches of nerves in which the affection is situated; loss of sense depending on an affection of the subcutaneous nerves; and loss of motion on an affection of these leading to the muscles.

Paralysis.

Causes, &c. Palsies most commonly supervene upon the different species of coma, especially the apoplexy. They are also occasioned by any debilitating power applied to the body, especially excesses in venery. Sometimes they are a kind of crisis to other distempers, as the colic of Poictou, and the apoplexy. The hemiplegia especially often follows the last mentioned disease. Aged people, and those who are by any other means debilitated, are subject to palsy; which will sometimes also affect even infants, from the repulsion of exanthemata of various kinds. Palsies are also the infallible consequences of injuries of the large nerves.

Prognosis. Except in the slighter cases of palsy, we have little room to hope for a cure; however, death does not immediately follow even the most severe paralytic affections. In an hemiphlegia it is not uncommon to see the patients live several years; and even in the paraplegia, if death do not ensue within two or three weeks, it may not take place for a considerable time. It is a promising sign when the patient feels a slight degree of painful itchness in the affected parts; and if a fever should arise, it bids fair to cure the palsy. When the sense of feeling remains, there is much more room to hope for a cure than where it is gone, as well as the power of motion. But when we observe the flesh to waste, and the skin to appear withered and dry, we may look upon the disease to be incurable. Convulsions supervening on a palsy are a fatal sign.

Cure. Many remedies have been recommended in palsies: but it must be confessed, that, except in the slighter cases, medicines seldom prove effectual; and before any scheme of cure can be laid down, every circumstance relative to the patient's habit of body and previous state of health should be carefully weighed. If an hemiplegia or paraplegia should come on after an apoplexy, attended with those circumstances which physicians have supposed to denote a viscid state of the blood, a course of the attenuant gums, with fixed alkaline salts, and chalybeate waters, may do service; to which it will be proper to add frictions with the volatile liniment all down the spine: but in habits where the blood is rather inclined to the watery state, it will be necessary to give emetics from time to time; to apply blisters, and cut issues.

The natural hot baths are often found useful in paralytic cases; and where the patients cannot avail themselves of these, an artificial bath may be tried by dissolving

Comata. diſſolving ſalt of ſteel in water, and impegnating the water with fixed air. Frictions of the parts, and ſcourging them with nettles, have alſo been recommended, and may do ſervice, as well as volatile and ſtimulating medicines taken inwardly. And it is probably by operating in this manner, that the uſe of camphor, or a mercurial courſe continued for ſome length of time to ſuch a degree as gently to affect the mouth, have been found productive of a cure in obſtinate caſes of this affection. Of late years, an infuſion of the arnica montana or German leopard's bane, has been highly extolled in the cure of this diſeaſe by ſome foreign writers: but the trials made with it in Britain, particularly at Ediuburgh, have been by no means equally ſucceſsful with thoſe related by Dr Collins, who has ſtrongly recommended this medicine to the attention of the public.

269 Sp. IV. The PALSY from *Poiſons.*

Paralyſis metallariorum, *Sauv.* ſp. 22.
Hemiplegia ſaturnina, *Sauv.* ſp. 14.

This kind of palſy ariſes moſt frequently from lead taken into the body, and is a conſequence of the colica pictonum, under which it is more particularly treated.

274 TREMOR, or TREMBLING.

Tremor, *Sauv.* gen. 129. *Lin.* 139. *Vog.* 184. *Sag.* 236.

This by Dr Cullen is reckoned to be always ſymptomatic either of palſy, aſthenia, or convulſions; and therefore need not be treated of by itſelf.

271 ORDER II. ADYNAMIÆ.

ADYNAMIÆ, *Vog.* Claſs VI.
Defectivi, *Lin.* Claſs VI. Order I.
Leipopſychiæ, *Sauv.* Claſs VI. Order IV. *Sag.* Claſs IX. Order IV.

272 GENUS XLIV. SYNCOPE.
FAINTING.

Syncope, *Sauv.* gen. 174. *Sag.* 94. *Vog.* 274. *Sag.* 280. *Junck.* 119.
Leipothymia, *Sauv.* gen. 173. *Lin.* 93. *Vog.* 273. *Sag.* 279.
Aſphyxia, *Sauv*, gen. 175. *Lin.* 95. *Vog.* 275. *Sag.* 281.
Virium lapſus et animi deliquia. *Hoffm.* III. 267.

273 Sp. I. The *Cardiac* SYNCOPE.

Syncope plethorica, *Sauv.* ſp. 5. *Senac* Tr. de Cœur, p. 540.
Syncope a cardiogmo, *Sauv.* ſp. 7. *Senac.* de Cœur, 414. *Morgagn.* de Sed. XXV. 2. 3. 10.
Syncope a polypo. *Sauv.* ſp. 8. *Senac.* p. 471.
Syncope ab hydrochardia, *Sauv.* ſp. 12. *Senac.* 533. *Schreiber* Almag. L. III. § 196.
Syncope *Lanzoni*, *Sauv.* ſp. 18. *Lanzon.* Op. II. p. 462.
Aſphyxia Valſalviana, *Sauv.* ſp. 13.

274 Sp. II. *Occaſional* SYNCOPE.

Leipothymia a pathemate, *Sauv.* ſp. 1. *Senac* p. 544.
Syncope pathetica, *Sauv.* ſp 21.
Aſphyxia a pathemate, *Sauv.* ſp. 7.
Syncope ab antipathia, *Sauv.* ſp. 9. *Senac.* p. 544.
Syncope a veneno, *Sauv* ſp. 10. *Senac.* p. 546.
Syncope ab apoſtematis, *Sauv.* ſp. 11. *Senac.* p. 554.
Syncope a ſphacelo, *Sauv.* ſp. 14. *Senac.* p. 553.
Syncope ab inantione, *Sauv.* ſp. 1. *Senac.* p. 536.
Syncope a phlebotomia, *Sauv.* ſp. 4.
Syncope a dolore, *Sauv.* ſp. 2. *Senac.* p. 583.
Aſphyxia traumatica, *Sauv.* ſp. 14.
Aſphyxia neophytorum, *Sauv.* ſp. 17.

Syncope

Deſcription. A ſyncope begins with a remarkable anxiety about the heart; after which follows a ſudden extinction, as it were, not only of the animal powers and actions, but alſo of the vital powers, ſo that the patients are deprived of pulſe, ſenſe, and motion, all at once. In thoſe caſes which phyſicians have diſtinguiſhed by the name of *leipothymia*, the patient does not entirely loſe his ſenſes, but turns cold and pale; and the pulſe continues to beat, though weakly; the heart alſo ſeems to tremble rather than beat; and the reſpiration is juſt perceptible. But in the true ſyncope or full aſphyxia, not the ſmalleſt ſign of life can be perceived; the face hath a death-like paleneſs, the extremities are cold, the eyes ſhut, or at leaſt troubled; the mouth ſometimes ſhut, and ſometimes gaping wide open; the limbs flaccid, and the ſtrength quite gone; as ſoon as they begin to recover, they fetch deep and heavy ſighs.

Cauſes, &c. Fainting is occaſioned moſt commonly by profuſe evacuations, eſpecially of blood; but it may happen alſo from violent paſſions of the mind, from ſurfeits, exceſſive pain, &c. People of delicate conſtitutions are very ſubject to it from ſlight cauſes; and ſometimes it will ariſe from affections of the heart and large veſſels not eaſy to be underſtood. Fainting is alſo a ſymptom of many diſorders, eſpecially of that fatal one called a *polypus of the heart*, of the plague, and many putrid diſeaſes.

Prognoſis. When fainting happens in the beginning of any acute diſtemper, it is by no means a good omen; but when it takes place in the increaſe or at the height of the diſeaſe, the danger is ſomewhat leſs; but in general, when fainting comes on without any evident cauſe, it is to be dreaded. In violent hæmorrhagies it is favourable; as the bleeding veſſels thus have time to contract and recover themſelves, and thus the patient may eſcape.

Cure. When perſons of a full habit faint through exceſs of paſſion, they ought to be blooded without delay, and ſhould drink vinegar or lemon-juice diluted with water; and, after the bowels are emptied by a clyſter, take a paregoric draught, and go to bed.

The paſſion, of anger, in a peculiar manner, affects the biliary ſecretion, cauſes an oppreſſion at the ſtomach, with naufea and retching to vomit, and a bitter taſte in the mouth, with giddineſs: theſe ſymptoms ſeem to indicate an emetic; which, however, in theſe caſes muſt be carefully avoided, as it might endanger the patient, by bringing on an inflammation of the ſtomach.

The general effects of a ſudden fright have been mentioned on a former occaſion. When theſe are ſo violent as to require medical aid, our firſt endeavours

 muſt

Adynamiæ must be to take off the spasmodic constriction, and restore freedom to the circulation; by bleeding, if the habit be at all inclined to fulness; and by giving a mixture, with equal parts of the vinum antimoniale and tinctura opii camphorata, in some agreeable vehicle, which will bring on sleep and encourage perspiration. It was formerly mentioned, that convulsions, or even an epilepsy, may be brought on by frights; which should make people cautious of playing foolish tricks in this way.

When a surfeit, or any species of saburra, occasions a leipothymia, an emetic is the immediate remedy, as soon as the patient, by the help of acrid stimulants, shall be so far roused as to be able to swallow one: in these cases, tickling the fauces with a feather dipt in spirit of hartshorn, will be proper, not only to rouse the patient, but also to bring on vomiting.

A syncope is most commonly brought on by profuse discharges or evacuations, either of the blood or of the secreted humours.

In order to revive the patients, they ought to be laid along in a horizontal posture, in an airy place; the legs, thighs, and arms, are to be rubbed with hot flannels; very strong vinegar, or salt of hartshorn, or volatile alkaline spirit, are to be held to the nostrils, and rubbed into them; or, being properly diluted, poured down the throat; cold water is to be sprinkled on the face and neck; and when by these means the patient shall be sufficiently revived, wine boiled up with some grateful aromatic, is to be given in the proper quantity.

In the fainting consequent upon profuse uterine hæmorrhagies, it will be a safer practice to abstain from all heating and stimulant things; as life, in these cases, is preserved by the coagulation of the blood in the extremities of the open vessels; which might be prevented by the pouring in hot wine or volatile alkaline spirits.

When a syncope is the consequence of the too violent operation of either an emetic or cathartic, the tinctura thebaica, mixed with spiced wine, is the most efficacious remedy; but the opiate must be given gradually, and in very small doses.

A syncope, or even asphyxia, wherein the patient shall lie for several hours, is frequent in hysteric constitutions; and during the fit requires fetid antispasmodics, together with acrid stimulants: to prevent returns, nothing answers better than the Peruvian bark joined with chalybeates.

Genus XLV. DYSPEPSIA.

275 *Depraved Digestion.*

Dyspepsia, *Vog.* 277.
Apepsia, *Vog.* 276.
Diaphora, *Vog.* 278.
Anorexia, *Sauv.* gen. 162. *Lin.* 116. *Sag.* gen. 286.
Cardialgia, *Sauv.* gen. 302. *Lin.* 48. *Vog.* 157. *Sag.* gen. 160.
Gastrodynia, *Sauv.* gen. 203. *Sag.* gen. 161.
Soda, *Lin.* 47. *Vog* 161.
Nausea, *Sauv.* gen. 250. *Lin.* 182. *Vog.* 159. *Sag.* gen. 185.
Vomitus, *Sauv.* gen. 251. *Lin* 183. *Vog.* 214. *Sag.* gen. 186.
Flatulentia, *Sauv.* gen. 272. *Lin.* 165. *Vog.* 127. *Sag.* gen. 207.

Dyspepsia.

The idiopathic species are,

Anorexia pituitosa. *Sauv.* sp. 2.
Anorexia a saburra, *Sauv.* sp. 9.
Anorexia exhaustorum, *Sauv.* sp. 8.
Anorexia paralytica, *Sauv.* sp. 1.
Nausea ex cacochylia, *Sauv.* sp. 11.
Vomitus pituitosus, *Sauv.* sp. 26.
Vomitus ruminatio, *Sauv.* sp. 6.
Vomitus a saburra, *Sauv.* sp. 2.
Vomitus a crapula, *Sauv.* sp. 1.
Vomitus lacteus, *Sauv.* sp. 3.
Flatulentia infantilis, *Sauv.* sp. 5.
Flatulentia acida, *Sauv.* sp. 1.
Flatulentia nidrosa, *Sauv.* sp. 2.
Cardialgia bradypepta, *Sauv.* sp. 9.
Cardialgia a saburra, *Sauv.* sp. 2.
Cardialgia lactantium, *Sauv.* sp. 11.
Cardialgia flatulenta, *Sauv.* sp. 3.
Cardialgia paralytica, *Sauv.* sp. 7.
Gastrodynia saburralis, *Sauv.* sp. 1.
Gastrodynia flatulenta, *Sauv.* sp. 2.
Gastrodynia periodynia, *Sauv.* sp. 7.
Gastrodynia astringens, *Sauv.* sp. 9.
Gastrodynia atterens, *Sauv.* sp. 10.
Gastrodynia a frigore, *Sauv.* sp. 18.

Besides these there are a great number of symptomatic species.

Description. It is by no means easy to define exactly the distemper called *dyspepsia*, when considered as an original disease, as there are very few maladies which some way or other do not show themselves by an affection of the stomach; and much more difficult still must it be to enumerate all its symptoms. The most remarkable, however, and the most common, are the following: Want of appetite; distension of the stomach when no food has been taken for some time before; slight dejection of spirits; a gradual decay of the muscular strength; languor, and aversion from motion; the food which is taken without appetite is not well digested; the stomach and intestines are much distended with flatus, whence the patients are tormented with spasms, gripes, and sickness: frequently a limpid water, having an acid or putrid taste, is brought up; sometimes the food itself is thrown up by mouthfuls; and sometimes, though rarely, the same is swallowed again, after the manner of ruminating animals. While matters are in this situation, the heart sometimes palpitates, and the breath is quick, and drawn with difficulty; the head achs and is giddy; and sometimes both these symptoms are continual, and very violent, insomuch that the patient is not only tormented with pain, but staggers as if he was drunk. From the too great acescency or putrefaction of the aliment, a cardialgia or heartburn comes on; and in this situation a spontaneous diarrhœa sometimes carries off the disease; but in other cases there is an obstinate costiveness, attended with colic-pains. Frequently the pulse is quick, sometimes slow, but always weak: the circulation is so languid, that the blood can scarce reach the extreme vessels, or at least stagnates;

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ſtagnates in them, ſo that the face becomes livid, ſwelled, and has an unuſual appearance: and at the ſame time that the circulation and nervous power are in this languid ſtate, the perſpiration becomes leſs copious, the ſkin becomes dry and corrugated; the natural heat, eſpecially of the extremities, is much diminiſhed; the tongue is white; and an univerſal laxity takes place, inſomuch that the uvula and velum pendulum palati are ſometimes enlarged to ſuch a degree as to become extremely troubleſome. The patient is either deprived of reſt or wakes ſuddenly out of his ſleep, and is diſturbed by frightful dreams; at the ſame time that the mind ſeems to be affected as well as the body, and he becomes peeviſh, fretful, and incapable of paying attention to any thing as uſual. At laſt hectic ſymptoms come on, and the whole frame becomes ſo irritable, that the ſlighteſt cauſe excites an univerſal tremor, and ſometimes violent vomiting and diarrhœa. Sometimes the ſalivary glands are ſo relaxed, that a ſalivation comes on as if excited by mercury; the ſerum is poured out into the cavity of the abdomen and cellular ſubſtance of the whole body, and the patient becomes affected with anaſarca or aſcites.

Cauſes &c. The cauſes of dyſpepſia may be any thing which debilitates the ſyſtem in general, but in a particular manner affects the ſtomach. Such are opium taken in immoderate quantities, which hurts by its ſedative and relaxing powers; ſpirituous liquors drunk to exceſs; tobacco, tea, coffee, or any warm relaxing liquor, taken in too great quantity; acid, unripe fruits; vomits or purges too frequently taken; an indolent ſedentary life, &c. &c. All theſe act chiefly upon people of a weak and delicate habit; for the robuſt and hardy ſeldom labour under a dyſpepſia, or at moſt a very ſlight one.

Prognoſis. When a dyſpepſia firſt occurs, it is frequently removed without great difficulty; when it is ſymptomatic, we muſt endeavour to cure the primary diſeaſe; and without this we cannot expect a complete removal of the affection: but when it frequently returns with ſymptoms of great debility, hectic fever, or dropſy, we have great reaſon to dread the event.

Cure. A radical cure of dyſpepſia is only to be expected by removing from the ſtomach and ſyſtem that debility on which the diſeaſe depends. On this ground, the objects chiefly to be aimed at in the cure are, 1ſt, The avoiding whatever will tend to diminiſh the vigour of the ſtomach; 2d, The employing ſuch remedies as have influence in encreaſing that vigour; and, in the third place, The obviating urgent ſymptoms, particularly thoſe which tend to increaſe and ſupport the affection. Of the avoiding cauſes, which tend to diminiſh the vigour of the ſtomach, after what has already been ſaid of the cauſes inducing the diſeaſe, it is unneceſſary to make any farther obſervations; and indeed every dyſpeptic patient will be taught by experience what is to be done with this intention. The medicines chiefly employed with the view of increaſing vigour are thoſe of the tonic kind: but, previous to their uſe, it will be neceſſary to evacuate the contents of the alimentary canal by vomits or purgatives. If there be a tendency to putreſcency, antiſeptics muſt then be exhibited; but more frequently there is a prevailing acidity, which creates an intolerable heart-burn. To palliate this ſymptom, magneſia alba may be given; which is much preferable to the common teſtaceous powders, as being purgative while diſſolved in an acid, when the others are rather aſtringent. In the third volume of the Medical Obſervations, we have an account of two caſes of dyſpepſia attended with a very uncommon degree of cardialgia, in which magneſia was ſo ſucceſsful, that we can ſcarce doubt of its efficacy in ſlighter degrees of the diſorder. They were communicated by Dr Watſon.

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"A woman, aged 34, the mother of ſeveral children, was taken, in the fourth month of her pregnancy, with violent vomitings; which growing daily worſe, notwithſtanding the endeavours of her apothecary to reſtrain them, brought on at the end of a month ſuch ſevere pains in the ſtomach, and ſpaſms in her abdomen, as to occaſion abortion. The vomitings were not leſſened by this event, but grew worſe and frequently brought on general convulſions to ſuch a degree, that ſhe was many times ſuppoſed to be at the point of death.

"Scarce any medicine ſtaid with her; ſhe brought up almoſt inſtantly whatever was given her as nouriſhment, either in a ſolid or a liquid form. She was exceedingly pale, and very much emaciated; her fleſh was cold to the touch; and, though her urine was little in quantity, it was perfectly limpid. She had a continual thirſt, and was, in a conſiderable degree, coſtive. Her pulſe was low and quick, and ſhe was frequently tormented with the hiccough. The pain in her ſtomach was ſevere and conſtant; and whatever ſhe brought up was ſharp to ſuch a degree as to make her mouth and throat very ſore. Theſe parts upon examination appeared high-coloured, and in many places excoriated; and the pain ſhe felt in her ſtomach upon ſwallowing any liquor that had the leaſt degree of acrimony, or was more than luke-warm, made it probable the ſtomach itſelf, in its internal ſurface, was affected in the ſame manner.

"In this wretched ſtate I was conſulted; and muſt confeſs that I was much at a loſs how to relieve a patient ſo debilitated, and whoſe ſtomach was in ſo diſeaſed a ſtate, that it ſeemed incapable of retaining any appropriated remedies long enough to correct the acrimony of the juices, and reſtore the ſecretions to a more mild and natural ſtate. Anti-emetics of various kinds had been tried without effect, particularly ſaturated ſolutions of alkaline ſalt in juice of lemons. Stomachic medicines of the warm and aromatic kind ſhe could not bear, on account of their poignancy; and, though nothing could ſo ſpeedily correct the almoſt cauſtic acid of the gaſtric juice as ſolutions of alkaline ſalts, neither the fauces nor gullet could bear their acrimony.

"My expectations of relieving this patient, ſmall as they were, depended upon my being able to neutralize, and thereby leſſen, the ſtimulus of the acid of the ſtomach. To accompliſh this was not very eaſy, as no medicine in ſmall doſes could in any conſiderable degree correct ſo intenſe an acid; and, in the preſent ſituation, it was difficult to get any medicine to ſtay long enough to exert its effects. To diſcharge however what acrid matter might be already accumulated

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in the ſtomach, I directed that the patient ſhould drink plentifully of ſmall, warm, unſalted mutton-broth, and vomit with it ſo long that it ſhould be diſcharged with no other taſte than that of broth. This was complied with, and a large quantity drank. The pain in her ſtomach ceaſed upon this for more than two hours, and was after that time apparently coming on with the ſame violence as before. Upon which I ordered a drachm of magneſia to be given in two ounces of veal-broth. This kept down, and eaſed her; I therefore directed the ſame doſe to be repeated as often as the pain returned, without any regard to the quantity that the whole might amount to, ſuppoſing that the pain continued ſevere. This was done; and in three days ſhe took three ounces of magneſia, of which very few doſes were vomited up, and ſhe was purged conſiderably.

"This medicine was continued in a ſomewhat leſs quantity for three days longer, in which ſhe took two ounces more of magneſia; by this time the vomitings ceaſed, the convulſions left her, ſhe had no pains in the ſtomach, and her mouth and fauces loſt their intenſely red colour and ſoreneſs; nor did even her eructations longer indicate any acidity.

"Beſides veal-broth ſhe was allowed boiled rice, and now and then ſome rice gruel with a ſmall quantity of brandy; and after a few days more ſhe could retain boiled chicken, and other light, ſolid, animal-food.

"When her ſtomach was in this ſtate, ſhe took liberally of *decoct cort. Peruvian*, with a ſmall portion of French brandy; by which and her nouriſhment ſhe recovered her ſtrength ſurpriſingly. To this medicine, as ſhe was during the latter part of her illneſs conſiderably anaſarcous, were added ſome preparations of ſteel; and in about a month ſhe perfectly recovered.

"When this patient's ſtomach was relieved, the thirſt, the general and partial ſpaſms, and other complaints, which were merely ſymptomatic, ſoon ceaſed; and what remained of her cure was by no means difficult.

"Since the above-recited caſe, I was conſulted in another almoſt in every reſpect ſimilar, except that the former began in pregnancy. The vomitings attended with acidity had continued more than a month; the patient's ſtomach rejected every kind of food and medicine; ſhe was debilitated to a great degree, and univerſally anaſarcous.

"Upon being ſent for, I directed for her magneſia, much in the ſame manner as for the former patient; and in a very few days her vomitings ceaſed, her ſtomach became ſtronger, and in leſs than a fortnight the anaſacra diſappeared. But it was a conſiderable time, as this perſon was more advanced in years than the former, before ſhe recovered her ſtrength, notwithſtanding my beſt endeavours for that purpoſe. She at length, however, perfectly recovered."

But although acidity may often be ſucceſsfully obviated in this manner, yet the beſt way of counteracting this ſymptom, as well as of obviating coſtiveneſs, flatulence, and a variety of others, is by reſtoring the tone of the ſtomach in particular, and indeed of the ſyſtem in general. With this intention, recourſe is had to a variety of tonics both from the mineral and vegetable kingdom; particularly chalybeates in different forms, gentian, colombo, and the like; but of all the tonics which can be employed in this affection, none are attended with greater benefit than exerciſe and cold bathing; and the proper and prudent employment of theſe is no leſs effectual in removing the diſeaſe, than in preventing the return of it after it is once removed.

Dyſpepſia.

Genus XLVI. HYPOCHONDRIASIS.
Hypochondriac Affection. 276

Hypochondriaſis, *Sauv.* gen. 220. *Lin.* 76. *Vog.* 218. *Sag.* 332.
Morbus hypochondriacus, *Boerh.* 1098.
Malum hypochondriacum, *Hoffm.* III. 65. *Junck.* 36.

Although ſome of the noſological writers, particularly Sauvages, have conſidered this genus as conſiſting of different ſpecies, Dr Cullen is of opinion, that there is only one idiopathic ſpecies, the *hypochondriaſis melancholica*. He conſiders not only the hypochondriaſis hyſterica, phthiſica, and aſthmatica, but alſo the bilioſa, ſanguinea, and pituitoſa, as being only ſymptomatic; but he views the true melancholic hypochondriaſis as being a proper idiopathic diſeaſe, perfectly diſtinct from hyſteria, with which it has often been confounded.

Deſcription. The ſymptoms of hypochondriaſis are, ſtretching, preſſing, griping, and tormenting pains, under the ribs, and chiefly in the left ſide; which ſometimes are exaſperated, and become pungent, burning, or lancinating. Frequently there is an inflation of the left hypochondriacum, which ſometimes becomes ſtationary, and by Hippocrates was taken for a ſymptom of an enlarged ſpleen. When theſe ſymptoms take place in the right hypochondrium, they are commonly attended with colic-pains, uncertain flying heats, eſpecially in the head, with a tranſient redneſs of the face, and very frequently an œdematous ſwelling of the feet ſucceeds. To theſe are ſuperadded almoſt all the affections of the ſtomach occurring in dyſpepſia, beſides a variety of other ſymptoms, ſuch as palpitations, ſleepleſs nights, and the like. But beſides theſe, there occurs alſo a particular depreſſion of ſpirit and apprehenſion of danger which may be conſidered as one of the great characteriſing ſymptoms of the diſeaſe.

Cauſes, &c. The general cauſes of the hypochondriac affection are ſaid to be a plethora, and preternatural thickneſs of the blood; ſuppreſſions of cuſtomary evacuations; high and full diet, together with a ſparing quantity of drink; an hereditary diſpoſition; indolence; atony of the inteſtines; violent paſſions of the mind, &c.

Prognoſis. The hypochondriac affection, when left to itſelf, is more troubleſome than dangerous; but, if improperly treated, it may bring on various diſeaſes of a more fatal tendency, ſuch as the melancholy, bloody urine and nephritis, jaundice, vertigo, palſy, apoplexy, &c.

Cure. This is to be attempted by ſuch medicines as counteract occaſional cauſes, and obviate urgent ſymptoms,

Adynamiæ symptoms, which may be all comprehended under bleeding, gentle evacuants, chalybeates, the Peruvian bark, and exercise, especially riding on horseback, which in this disease is greatly preferable to any other. When the circumstances of the patient can afford it, a voyage to Spain, Portugal, or some of the warmer countries in Europe, will be of great service.

277 GENUS XLVII. CHLOROSIS.
GREEN SICKNESS.

Chlorosis, *Sauv.* gen. 309. *Lin.* 222. *Vog.* 305. *Sag.* gen. 135. *Boerh.* 1285. *Hoffm.* iii. 311. *Junck.* 86.

Of this genus also Dr Cullen thinks there is but one idiopathic species: viz. what some distinguish by the title of *chlorosis virginea*, others of *chlorosis amatoria*.

Description. This disease usually attacks girls a little after the time of puberty, and first shows itself by symptoms of dyspepsia. But a distinguishing symptom is, that the appetite is entirely vitiated, and the patient will eat lime, chalk, ashes, salt, &c. very greedily; while at the same time there is not only a total inappetence to proper food, but it will even excite nausea and vomiting. In the beginning of the disease, the urine is pale, and afterwards turbid; the face becomes pale, and then assumes a greenish colour; sometimes it becomes livid or yellow: the eyes are sunk, and have a livid circle round them; the lips lose their fine red colour; the pulse is quick, weak, and low, though the heat is little short of a fever, but the veins are scarcely filled; the feet are frequently cold, swell at night, and the whole body seems covered with a soft swelling; the breathing is difficult: nor is the mind free from affection as well as the body; it becomes irritated by the slightest causes; and sometimes the patients love solitude, become sad and thoughtful. There is a retention of the menses throughout the whole course of the disorder; and at last all the bad symptoms increasing, a leucophlegmasia, anasarca, atrophy, and death, succeed.

Causes. The cause of chlorosis is thought to be an atony of the muscular fibres of the alimentary canal, especially of the stomach, joined with a similar atony of the perspiratory vessels over the whole surface of the body, and the whole depending on an atony of those small arteries which pour out the menstrual blood. This atony may be occasioned by the same causes which bring on dyspepsia and hypochondriasis, but very frequently arises from love and other passions of the mind.

Prognosis. The chlorosis in all cases is tedious, though it does not generally prove fatal; but we can never promise a certain cure unless the menses make their appearance.

Cure. The remedies here in general are the same as in the dyspepsia and hypochondriasis; only in the chlorosis stronger purgatives may be made use of: those which stimulate the rectum are useful by stimulating also the vessels of the uterus; and for this reason indulgence in venery has sometimes been said to produce a cure, particularly with love-sick maids. The cold bath is also extremely proper.

Order III. SPASMI.

SPASMI, *Sauv.* Class IV. *Vog.* Class V. *Sag.* Class VIII.
Motorii, *Lin.* Class VII.
Morbi spasmodici et convulsivi, *Hoffm.* III. 9.
Spasmi et convulsiones, *Junck.* 45, 54.
Epilepsia, *Boerh.* 1071, 1088.

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GENUS XLVIII. The TETANUS. 279

Tetanus, *Sauv.* gen. 122. *Lin.* 127. *Vog.* 180. *Sag.* gen. 228.
Catochus, *Sauv.* gen. 123. *Lin.* 128. *Vog.* 183. *Sag.* gen. 229.
Opisthotonos, *Vog.* 181.
Episthotonos, *Vog.* 182.

On this distemper Dr Lionel Chalmers has published a dissertation in the first volume of the Medical Observations, which being superior to any thing that has appeared in other medical writers on the subject, we shall here lay before the reader,

"Of all the diseases to which man is subject, none deserves more to be considered than the opisthotonos and tetanus, either with regard to the variety of painful symptoms which almost without intermission distract the sick, or the danger of the diseases themselves, from which few recover, in comparison of the number they attack. In both, the vital actions are very imperfectly performed, most of those which are called *natural* being as it were suspended at once; and so far is the patient from being able to execute any voluntary motion, that the whole machine undergoes the most excruciating distortions, from the violent and unnatural contractions of the muscles. Happy it is for the inhabitants of the more temperate climates, that such diseases appear rarely among them; but in those countries which lie in the more southern and warmer latitudes, they are endemic, especially to negro slaves. In South Carolina, they show themselves at all seasons, but not so often in winter, more frequently in spring and autumn; and are most common in the summer, when people work abroad and are alternately exposed to the scorching heat of the sun and heavy showers, which often happen suddenly, and greatly alter the temperature of the air. Others are seized with the opisthotonos after sleeping without doors, that they may enjoy the deceitful refreshment of the cool night-air, when the weather is warm: one youth chose to cut off his hair and shave his head on a warm day in March, and went to bed without a cap; but the weather changed, and became cold in the night, and he was found rigid with that disease next morning.

"These diseases so rarely appear as originals in Europe, that a good history of them cannot be expected from the physicians who practice in that part of the world; nor has any thing like a full description been given of them by any ancient or modern author which I have seen. Hippocrates indeed takes notice of them in many places, and seems to regard them only as consequences of other diseases, or of wounds or ulcers of the nervous or tendinous parts, of which symptomatic kind of opisthotonos he gives three remarkable cases in *lib.* V. § VII. *de. Morb. vulg.* and repeats

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repeats them in another place; but the few symptoms he recounts do not show themselves with us. Galen, Cœlius Aurelianus, Aretæus, &c. seem only to have copied Hippocrates, with the addition of some supposititious symptoms, which really do not appear; and the little that Bontius says of it is very faulty.

"Among the numerous class of spasmodic diseases, there are three which distinguish themselves in a very particular manner, on which the names of *emprosthotonos*, *opisthotonos*, and *tetanus*, have been justly enough bestowed, as being expressive of the posture into which they throw and confine the patient. When therefore those muscles which bend the head, neck, and body forwards, suffer such involuntary, violent, and continued contractions, as to fix the chin to the breast, incurvate the spine and body, and retain the sick in this painful and prone posture, the disease is called *emprosthotonos*. When the posterior muscles are similary affected, so that the head is drawn towards the spine, and the spine itself is recurvated, it has then the name of *opisthotonos*; although in fact, in this, all those muscles which act in deglutition, bend the head forwards, or turn it to either side, are equally contracted with those which raise the head and spine. The *tetanus* differs from, or rather is compounded of, both the others; for in this the patient is found rigid and inflexible, being as it were braced between the opposite contractions of the anterior and posterior muscles; yet even here the head is much retracted.

"I never saw the *emprosthotonos*; and shall only speak of the *opisthotonos* and *tetanus*, the first being by far the most common, and in the last stage of which the tetanus frequently supervenes. And let it be observed, that the following description by no means respects such symptomatic contractions as often happen immediately before death, both in acute and chronic diseases; neither will it agree with that spurious *opisthotonos* or *tetanus* which appear sometimes in the first and second stages of quotidian intermittents in this country, however they may emulate the true diseases in some of their symptoms.

"Stad. I. The *opisthotonos*, contrary to what Bontius asserts, often comes on gradually and by slight approaches, the patient complaining rather of an uneasy stiffness in the back-part of the neck and about the shoulders, than of any acute pain, with some degree of a general lassitude. These increase, and become so troublesome when he attempts to turn his head, or to bend it forward, as to oblige him to walk very erect; for he can by no means look downward nor to either side, without turning his whole body. He cannot open his jaws without pain; and has some difficulty in swallowing, which discourages him from attempting to eat. At times he feels a sudden and painful traction under the *cartilago ensiformis*, which strikes thro' to the back and instantly increases the rigidity about the neck and shoulders, draws the head backwards a little, and shuts the jaws closer. The pain under the *sternum* returns more frequently and with greater violence; and the other contractions become so strong, that the head from this time continues much retracted, and he now refuses nourishment, as swallowing is attended with great pain, and occasions a return of the spasm; which extends along the spine quite to the lower extremitities, so that they will no longer support him, and he is under the necessity of going to bed.

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"In this manner passes over the first stage of the *opiosthotonos*, which sometimes takes up three or four days; the patient, as well as those about him, mistaking the first appearances of it for that rheumatic complaint, which is commonly called a *crick in the neck*; but it sometimes forms itself much quicker and invades the unfortunate person with the whole train of its mischievous symptoms in a few hours: in which case, the danger may truly be estimated from the violence of the first attack; for such generally die in 24, 36, or 48 hours, and very rarely survive the third day. But when it is less acute, few are lost after the ninth or eleventh; which number of days it would not be possible for them to complete, unless the violence of the disease was in a good measure subdued; although I had one who recovered, after having been subject to its tyrannical attacks daily for six weeks. In this stage the pulse is slow, and very hard, and the belly is bound; blood taken away seems not to be altered from the natural state, so that no indication can be deduced therefrom, and it only varies with regard to laxity or compaction, according to the age of the person and season of the year.

"Stad. II. The spasm under the sternum (which is the pathognomic symptom of this disease) becomes more violent, returning every 10 or 15 minutes; and never fails to be instantly succeeded by a stronger retraction of the head, with great rigidity and pain all round the neck, and along the spine to the lower extremities which are suddenly put to the stretch. The countenance is very pale and contracted; the jaws are that moment snapped together, and cannot afterwads be opened so wide as to receive the end of one's little finger; an attempt to do which, by way of experiment, surely hurries on the spasm. The mastoid, coracohyoid and sternohyoid muscles, as well as all the others concerned in deglutition, and the deltoid and pectorals, are most violently contracted, so that the shoulders are strongly raised forward, and the arms are stretched out or drawn across the body; but the wrists and fingers seem not to be affected.

"Such is the condition of the patient in the time of the spasm, which ceases in a few seconds: after which the shoulders and arms recline, and the inferior extremities relax; yet not so entirely, but that such a degree of rigidity for the most part remains as will not permit them to bend when this is attempted by another person; for as to the sick himself, he cannot at all move them. The muscles on the sides and forepart of the neck continue still contracted, although not so strongly; but their action is overcome by the number and strength of the posterior ones; so that the retraction of the head constantly remains. He breathes quick for some minutes, as if he had been excessively exercised; and the pulse is small, fluttering, and irregular, but both become more calm and slow. The face is sometimes pale in the intervals, but oftener flushed; and the whole countenance expresses strong appearances of the most melancholy distress, as well because of the dread he has of a return of the spasm, which he is sure will soon happen, as from the pain he suffers by the present contractions, and the more general

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"Stad. III. In this last stage, the patient is reduced to the most calamitous and distressful circumstances: for he is on a continual rack, according to the most literal meaning of that word; the spasm returning oftener than once in a minute, is much more violent, and holds him longer, so that he has scarcely any remission. The anterior muscles of the whole body now suffer equal contractions with the posterior; but the last overcome the force of the others, so that the spine is strongly recurvated, and forms a hollow arch with the bed, and he rests on the back part of the head and the heels. The belly is flat, and is drawn inward; and the muscles are so rigidly contracted, that they will not give way to pressure, and do not seem in the least to yield to the descent of the diaphragm in inspiration; the several muscles about the neck, sides, and abdomen, being plainly distinguishable from each other. Although the lower extremities are always rigid in this state, yet are they so suddenly and violently distended in the time of the spasms, that were it not for the standers-by, he would be projected feet foremost off the bed; while others again are as it were pushed upward with such a spring, that the head is struck with great force against whatever happens to be in the way, the thighs and legs being in this case no less rigid than the other parts. The tongue is spasmodically darted out, and is often miserably torn, as the teeth are that moment snapped together; so that it is necessary to prevent this by keeping the handle of a spoon, wrapped round with soft rags, between the teeth, when this can be done. At the time that the tongue is thus thrust out, the muscular flesh, which lies between the arch of the lower jaw and head of the trachea, seems to be drawn upwards within the throat. The countenance is very much contracted, and he is in a foam of sweat, the heat being very great; and the pulse between the spasms is exceeding quick, small, and irregular, although the heart throbs so strongly, that its motions may be plainly seen, and a palpitating subsultory kind of undulation may not only be felt, but perceived all over the epigastric region. The eyes are watery and languid, and a pale or bloody froth bubbles out from between the lips. The jaws are for the most part locked fast, so that it is impossible to give drink or nourishment, nor could he swallow if any thing was put into his mouth. In this state they are commonly delirious: and as they cannot subsist many hours under so great a suspension of the vital and natural functions, a mortal anxiety ensues and releases them; oftener a continued and severe spasm finishes the tragedy, when it was before almost at an end: but most frequently a general convulsion puts a period to their sufferings; and whichever way this happens, they for the most part relax just before death.

Tetanus. "In the *tetanus*, the general symptoms are nearly the same as in the opisthotonos, except that from the first attack, the lateral, abdominal, and other anterior muscles, are equally contracted with the posterior ones; and the arms become rigid as well as the lower extremities. The abdomen is always flat and rigid as in the last stage of the opisthotonos, and its contents seem to be thrust up into the thorax, which at the same time appears to be much dilated. There are here also some intervals between the spasms, in the time of which the cheeks are drawn towards the ears, so that all the teeth may be seen as in the spasmus cynicus. Deglutition is more free in this than in the other disease; yet so far is the sick from being equally balanced between the contractions of the opposite muscles, that the head is retracted and the spine is recurvated, although not quite so much as in the opisthotonos. And the spasm, which commences under the sternum, is likewise common to the tetanus, which terminates as the other, and on the same fatal days. But whoever recovers from either, labours long under a general atonia; and they cannot for some months raise themselves from a supine or recumbent posture without pain, nor without help for some time."

Prognosis and Cure. There has never been any thing like a crisis observed in these frightful cases, or favourable termination from the mere efforts of nature; and therefore all the physician's dependence must be upon art. As in cases of tetanic affections, the disease often arises from some particular irritation, the removal of this must necessarily be an important object in the cure: But where it cannot be removed, benefit may often be obtained by the prevention of its influence being communicated to the brain. When, however, that influence is communicated to the brain, a cure is to be expected only by diminishing and obviating it. This is principally brought about by the use either of those means which have a general tendency to diminish action, or of those which induce a different state of action. On these grounds the operation of those remedies which are employed with greatest success in this affection, may, we apprehend, be explained. Fortunately it has been found, that opium is capable of giving some relief, if administered in proper time, and if the disease happens not to be in the most violent degree; the warm bath must also be brought in aid; and the patients should lie horizontally in the bath, and while in it have the whole body extremely well rubbed: when taken out, they are not to be dried, but immediately put to bed wrapt in the softest blankets; and while they remain there, the belly ought either to stuped, or two or three bladders filled with warm water kept constantly lying on it. The bowels at the same time must, if possible, be kept open, by solutions of manna and *sal polychrest*, or some other purging salt, mixed with *oleum ricini;* or if that should not be at hand, with oil of sweet almonds and a little tincture of sena. The opiates are to be given in large and frequently repeated doses; such as a grain of the *extractum thebaicum*, or 20 drops of the tincture, every second or third hour; and it will be safest not to trust to the thebaic tincture which is kept ready prepared in the shops, but order the necessary dose of solid opium, and either give it in pills or dissolve it in some

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When the patients recover, they continue for a long time very relaxed and weak; and no wonder, since it is the nature of all spasmodic affections to leave behind them extreme weakness and relaxation of the muscular fibres. In order to perfect the recovery, a course of the Peruvian bark, and the Peruvian balsam is to be tried; and the spine may be rubbed with spirituous liniments, or with a mixture of rum and Barbadoes tar: but these and all other stimulating things, either internally or externally, during the violence of the spasms, must, in the opinion of some practitioners, be omitted, since all of them as well as blisters have been alledged to exasperate the disease.

This, in general, is the plan of treatment recommended by Dr Chalmers.

The same dreadful disorders frequently attack young children in the warm climates. Dr Hillary tells us, that they will there arise from the same causes which usually produce convulsions with children in Britain, *viz.* from a retention of the meconium or first excrement after birth; or from a glutinous matter which is too often found in the intestines of young children soon after the other is discharged; or from a cheesy matter from the coagulation of the milk by an acid in the stomach; or from hard excrements; or from something taken in by the mouth which is over acrid, or too hard to digest, which irritates their tender bowels, and so produces startings and convulsive spasms, with all the other symptoms which precede and accompany convulsions in young children in Britain. And this shows how much more readily and easily the nerves are affected and irritated in that warm climate, and the *tetanus* produced from a much less cause there, than it is in Britain, where it is but seldom seen. But these causes not being timely removed, their acrimony is increased partly by the heat of the climate, and partly by the fever which they produce, which still renders them more acrid, and so increases the irritation of their bowels, that it first brings on startings, then convulsive spasms, and regular convulsion fits; which, if not soon removed, usually end in a perfect *tetanus* there, and the disease is but seldom cured in such young children when it arrives at that state: for when the child lies in this miserable, rigid, immoveable condition, upon moving its hands or feet in the most gentle manner, or softly touching any part of its body, or giving it the least motion, even feeling its pulse in the most gentle tender manner, or the least noise, or even touching its clothes, will bring on the convulsive spasms, and cause it to be strongly convulsed backwards, or drawn into a rigid straight line, strongly extended and immoveable like a statue, and will so remain immoveable out of either of those postures for a considerable time, a minute or two; and when the disease is arrived at this degree, Dr Hillary thinks it is never cured. But if the physicians be called in time, before the *tetanus* has come on (which is too seldom the case there), though he finds strong convulsive spasms have seized the child, or that it has had a convulsive fit or two, it may most commonly be relieved, the coming of the *tetanus* be prevented, and the life of the babe saved, as Dr Hillary has more than once seen, by removing and carrying off the irritating cause which stimulates their tender bowels, by such gentle evacuations as are suitable to their age; and then quieting and composing the irritation of their nerves with proper anodynes, and correcting the remaining acrimony of the nutritious juices in the *primæ viæ*. Tetanus.

To answer these intentions, the following method, with variations *pro re nata et pro ratione ætatis*, as the cause is different, has been found to answer the desired effect the best: R. *Seri lactis* ℥ij. *Sapon. Venet.* ℈j. *Mannæ Calab.* ʒij. *vel* iij. *Ol. amygd. dul.* ℥ss. *Ol. fæniculi dul. gut.* ij. *Balf Peruv. gut.* v. *Misce, fi. enema quam primum injiciendum.*

And if the symptoms of the approaching *tetanus* will permit, he gives something of the following nature to assist the operation of the clyster, and to carry off the acrimony the sooner: R. *Aq. fem. fæniculi* ℥iij. *Magnes. albæ* ʒss. *Ocul. cancr. præp.* ʒj. *Syr. e cichor. cum rheo, Rosar. solut. ana* ʒiij. *Misce.* Or. R. *Aq. fem. fæniculi* ʒiij. *Sapon. amygdal.* ʒss. *Magnes. albæ* ʒss. *Syr. e cichor. cum rheo, Mannæ opt. ana* ʒij. *Ol. amygd. dul.* ʒiij. *Misce: Exhibe cochl. parv. vel duo pro ratione ætatis omni semihora, vel omni hora, donec respond. alvus.*

Two or three stools being obtained by these, the following is exhibited in order to abate the convulsive twitchings, and prevent the *tetanus* from coming on: R. *Aq. fem. fæniculi* ℥iij. *Magnes. albæ* ʒss. *Ocul. cancr. præp.* ʒj. *Moschi orient. gr.* iij. *Spir. C. C. gut.* xv. *Syr. e mecon* ℥ss. *Misce: Exhibe cochl. parv.* (a child's spoonful) *ter quaterve de die, vel sæpius, urgent. convuls. vel spasm.*

But if the symptoms show that the *tetanus* is more immediately coming on, so that we have no time to wait till the operation of the clyster and opening laxative be over, something of the following nature must be immediately given; or the *tetanus* will come on, and most probably prove fatal to such tender babes. R. *Aq. fæniculi* ʒiiij. *Moschi orient. gr.* j. *Tinct. Thebaic. gut.* iiij. *Syr. e mecon* ʒij. *Misce pro duobus dos. de quibus exhibe unam quam primum, et alteram si convul. spasm. redeunt.*

This, Dr Hillary observes, may be thought a bold attempt, to give *tinct. thebaica* to such a tender young infant: but it is to be considered that the little patient will certainly die if the *tetanus* seize it, and that it will come on if this do not prevent it; and he has known a bold ignorant old midwife give four or five drops of that tincture to a very young infant without any prejudice more than its dosing three or four hours, though not in this case, but in one much less violent.

The clyster may be given at the same time, and the opening laxative not long after it; though it may retard the operation of that for some time, yet it operates soon after, and gives relief; after which the other medicines, and fomenting the body and anointing it as before, may be used, if the physician finds it necessary; also a little of the laxative mixture may be given once or twice a-day, if the above julep does not answer

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answer that intention of keeping the child's body open for a few days afterwards, which in this case is generally found necessary to be observed.

These methods and medicines may be varied according to circumstances. For neither the same method nor the same medicines will answer in all cases, though the disease be the same; but they must be changed as the causes differ, or the constitution of the sick, or the time of the disease, or as some other circumstances may require: which is a thing of great importance, not only in this, but in the cure of most other diseases; wherefore it is mentioned here chiefly to caution the practitioners in the West Indies.

When proper medicines are thus timely and judiciously given in this case, they seldom fail to carry off the irritating cause, quiet and ease the nerves, remove the convulsions and spasms; and consequently prevent the tetanus from coming on, and the death of the patient. But if calling in the physician be deferred till the tetanus has already strongly seized the child, as is too often the case here, neither warm bathing, fomenting, nor any other methods or medicines whatever, will remove it or its causes, nor save the life of the little tender patient.

Dr Chalmers gives an account of his having cured one child seized with a *tetanus*, by purging with an infusion of rhubarb; to which a few grains of musk, and a little *ol. tartar. per deliq.* were added, together with the warm bath, and the frequent injection of glysters made with an infusion of camomile flowers, to each of which was added a small portion of Castile soap. It is much to be regretted, however, that in those cases where the assistance of the medical art is most wanted, it most generally fails. We have been assured by a gentleman who practised for some time in the warm parts of America, that out of 30 cases of the tetanus he had seen, not one of the patients recovered, though he had given opium to the quantity of 20 grains thrice a-day; and others, he was assured, had taken 30 grains thrice a-day. In the beginning of the disease, the medicine produced a violent headach; but towards the end, it had no manner of effect whatever. In two patients, the disease came on from the slightest causes imaginable. The one accidentally fell in attempting to avoid a loaded cart, and put the heel of his shoe upon one of his thumbs in rising; the other, in avoiding the same cart, slightly ruffled the skin of his nose. Both were seized with the tetanus; and both died, notwithstanding all possible assistance was given. The former had his thumb amputated without effect.

In the Edinburgh Physical and Literary Essays, Vol. III. Dr Donald Monro describes a new method of cure, communicated to him by a gentleman who was formerly a practitioner in Jamaica. While this gentleman practised in that island, he had under his care a great number of cases of tetanus attended with the locked-jaw. At first, he used to give very freely of opium, musk, and other medicines of this class; to bleed, and make other evacuations; while he used baths, fomentations, embrocations, and other external applications, but all without the least success; and, as he had lost a great many patients without being so lucky as to make one cure, he began to believe that this disorder always proved fatal, and was not to be cured by medicine, notwithstanding what some practioners had alledged. However, having received an unexpected hint concerning the good effects of the mercurial ointment in such cases, he resolved to try it; and ordered the first patient that offered to be put into a warm room, and to be rubbed two or three times a-day with the ointment, till such time as a salivation was raised; when he with pleasure observed, that as soon as the mercury began to affect the mouth, the convulsions of the muscles of the jaws, as well as all the other spasms and convulsions, ceased, and the patient was freed of all his complaints. After this, he treated every case of this kind which came under his care in the same manner, and cured twelve, which were all who applied to him for advice so early in the disorder that there was time to bring the mercury to the mouth before the fatal period was expected. A few died, in whom the disease was so far advanced before he saw them that there was not time to raise a salivation. None of the cases which were under this gentleman's care in the West Indies were the consequences of wounds or capital operations; nor has he had any opportunity of trying it since in cases of the locked jaw, which sometimes follows capital operations, owing to his having given over practice: but he thinks, that, from the similarity of the complaint, there is no doubt that the mercurial frictions would be equally efficacious in such cases, as when the disorder comes from catching cold or other such causes.

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In the second volume of the Medical Transactions, we have an account of a cure performed by Dr William Carter of Canterbury, by means very different from any of those above related.—On the 17th of May 1767, the doctor was called to a strong healthy man, in the 21st year of his age, and who had been confined to his bed for three weeks. What gave rise to his present disorder was a wound on the inner ankle of his right leg, which he had received six weeks before from a joiner's chisel. At that time his mouth was so far closed, as to admit only the most liquid nourishment, which he constantly sucked through his teeth: but his legs and jaw, and the whole length of the spina dorsi, were quite immoveable, being as stiff and rigid as those of a person long dead; his head was drawn backward, and he was frequently strongly convulsed. The motion indeed of both his arms was but a little impaired. From the beginning to the end, his sight, hearing, and memory, continued perfect; his appetite was good; and his senses, in the day-time, entire, though sometimes wandering in the night. As to his pulse, that was regular; if it deviated at all from the pulse of a person in health, it was rather slow than quick, and somewhat fuller than natural. Such was the situation of his patient; a detail of which had been given before the doctor set out on his journey, which he undertook with a determined resolution to make use of the method recommended by Dr Silvester, in the first vol. of Medical Observations and Inquiries, published in the year 1757, (and which has been related from Dr Chalmers and Dr Hillary.) But, on his arrival at the house, he found great quantities of the *extractum thebaicum* dissolved

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had been already given him; and that, for the five last days, he had taken no less than 28 grains of that medicine, with 50 grains of musk, in the space of 24 hours, without any sensible effect, except the bringing on a confused sleep, out of which he frequently awoke in great hurries, attended with a violent pain in the head, which almost deprived him of his senses. The doctor was afraid to extend the dose; and soon determined to take some other method, though at a loss what method to pursue, as, during a course of almost 30 years practice, nothing of the same kind had ever fallen under his cognizance before. Reflecting, however, that this disorder had always been deemed of the spasmodic kind, and that the good effects produced by the *extractum thebaicum* must probably be owing to the relaxing and resolving faculty of that medicine, he directed a blister to be applied between the shoulders, the whole length of the spine; the jaw to be anointed with the *oleum lateritium*; and a purge consisting of the *tinctura sacra*, *tinctura jalappi*, and the *syrupus de rhamno cathartico*, to be given him. This was repeated three several times afterwards, at the distance of three or four days between each dose. On the intermediate days, he was ordered the *oleum succini*, the fœtid gum, and the *oleum amygdalinum*. Of the first he took 30 drops, of the gum 20 grains, and of the last four ounces, in 24 hours. By these means, and these only, the convulsions soon ceased; and he grew daily better and better, till at the end of a fortnight he was able to walk about his room, and in less than three weeks became in all respects well, some small weakness in the parts only excepted. The jaw was relieved first, after that the spine, and last of all the legs. A pain and uneasiness in the places affected, neither of which he had felt before, were the forerunners of his approaching amendment.

From all this it seems reasonable to conclude, either that there is no certain remedy for tetanus in all cases, or that the medicines which prove effectual in one constitution will fail in another. Thus, it is possible, that in cases where opium proves ineffectual, mercury may be a remedy; and on the contrary, where mercury fails, opium may be effectual; and even where both are ineffectual, the antispasmodics recommended by Dr Carter may be of use. It is therefore necessary for physicians to be extremely careful to observe the effects of the first doses of their remedies: for if the symptoms show not the least appearance of remission after a large dose of opium, it is improbable that it can be cured by a repetition of the medicine; and as no time can be lost with safety, it will then be proper to apply mercurial ointment, or whatever else may be judged proper.—In the Edinburgh Medical Commentaries we have an account of the cold bath being used as a remedy, by Dr Thomas Cochrane, at that time physician at Nevis, now at Edinburgh. The patient was an East Indian boy, who had been gored by a cow, and afterwards exposed to a rainy damp air for some hours. Dr Cochrane ascribes his cure to the cold bath, which was applied by dashing the water upon his body. But as the patient at the same time got laudanum, at first in the quantity of 200 drops a-day, and afterwards in still larger doses; and had besides his throat and shoulders anointed with warm oil of turpentine, was bled, and had lenient glysters and laxatives; it is by no means easy to say what share the cold bath had in his cure. Dr Cochrane, however, says he has heard of some cases being treated successfully by cold water and the Peruvian bark in St Eustatia and St Kitt's, and in another letter mentions his having used the cold bath in other cases of tetanus with success. But since Dr Cochrane's publication, a more full and satisfactory account of the benefit of this practice has been communicated in a paper published by Dr Wright, in the sixth volume of the London Medical Observations. Dr Wright gives a particular account of six cases, in which the best effects were obtained from dashing cold water upon the patient; and he observes, that since he first used this method of cure he never failed in one instance to effect a recovery, and that in a shorter time than by any other method hitherto proposed. This practice has on some occasions been adopted by practitioners in Britain, although here the disease is a much less frequent occurrence. It has particularly been employed with success by Dr Currie of Liverpool; and we hope that still more extensive practice will confirm the benefit to be derived from it, although not in every instance, yet in many cases of this affection.

Tetanus.

Very lately a different mode of cure in this affection has been recommended by Dr Rush, professor of medicine in Philadelphia, in a paper intitled Observations on the Cause and Cure of Tetanus, published in the second volume of the Transactions of the American Philosophical Society. Dr Rush, viewing tetanus as being a disease occasioned by relaxation, thinks the medicines indicated to cure it are such only as are calculated to remove this relaxation, and to restore tone to the system. On this ground he recommends the liberal use of wine and the Peruvian bark; and tells us, that he has employed them with success in actual practice. When the disease arises from a wound of any particular place, he recommends stimulants to the part affected; such as dilatation of the wound, and filling it with oil of turpentine. How far this practice will be confirmed by more extensive experience, we cannot take upon us to determine. We may only observe, that a very contrary practice has been recommended as highly successful by some practitioners in Spain, where tetanic affections are a very frequent occurrence in consequence of slight accidents. There gentle emollients are strongly recommended, particularly immersing the wounded part in tepid oil for the space of an hour or so at a time, and repeating this application at short intervals. By this mode many cases, after very alarming appearances had taken place, are said to have been completely and speedily removed. While the practice is very simple, it appears at the same time in many respects very rational, and may perhaps be considered as well deserving a trial in the first instance.

Genus XLIX. TRISMUS. 280
The Locked Jaw.

Trismus, *Sauv.* gen. 117. *Lin.* 124. *Sag.* gen. 223. Capistrum, *Vog.* 208.

Sp. I. Trismus nascentium. 281

Locked Jaw in children under two months old.

Trismus nascentium, *Sauv.* sp. 1. *Heister.* Comp. Med. Pract. cap. xv. § 10. *Cleghorn* on the Diseases of Minorca, Introd. p. 53. *Hofer* in Act. Helvet. tom. i. p. 65.

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This distemper is so closely connected with the tetanus, that it ought rather to be accounted a symptom of the tetanus than a primary disease. We have accordingly discussed it under TETANUS.

282 Sp. II. The TRISMUS from *Wounds or Cold.*

Trismus traumaticus, *Sauv.* sp. 2. *Lond. Med. Obs.* Vol. I. art. 1. 7. Vol. II. 34. Vol. III. 31. Vol. IV. 7.
Angina spasmodica, *Sauv.* sp. 18. *Zwingeri* Act. Helvet. Tom III. p. 319.
Convulsio a nervi punctura, *Sauv.* sp. 2.
Trismus catarrhalis, *Sauv.* sp. 15. *Hillary*'s Barbadoes, 221. *Lond. Med. Obs.* Vol. IV. 7.

The internal remedies proper in all cases of the locked jaw, from whatever cause it may proceed, have been already mentioned under TETANUS: the external treatment of wounded parts which may give occasion to it belongs to the article SURGERY. But of this also we have offered some observations under the head of Tetanus; and, indeed, Trismus may be considered as being merely an incipient tetanus, or rather a slight degree of that disease.

283 GENUS L. CONVULSIO.
CONVULSIONS.

Convulsio, *Sauv.* gen. 128. *Lin.* 142. *Vog.* 191. *Sag.* gen. 235.
Convulsio universalis, *Sauv.* sp. 11.
Hieranosos, *Lin.* 144. *Vog.* 190.
Convulsio habitualis, *Sauv.* sp. 12.
Convulsio intermittens, *Sauv.* sp. 16.
Convulsio hemitotonos, *Sauv.* sp. 15.
Convulsio abdominis, *Sauv.* sp. 10.
Convulvsio ab inanitione, *Sauv.* sp. 1.
Convulsio ab onanismo, *Sauv.* sp. 13.
Scelotyrbe festinans, *Sauv.* sp. 2.

Description. When convulsions attack only particular parts of the body; they are generally attended with some kind of paralysis at the same time, by which means the affected parts are alternately convulsed and relaxed; a permanent convulsion, or unnatural contraction of particular muscles, is called a *spasm* or *cramp*. These partial convulsions may attack almost any part of the body; and are not unfrequently symptomatic, in fevers, the cholera morbus, &c. The involuntary startings of the tendons, the picking of the bed-clothes, &c. in acute diseases, &c. are all of them convulsive disorders. Convulsions, even when most generally extended, differ from epilepsy in not being attended with any mental affection or abolition of sense, and not followed by the same torpid state.

Causes. Convulsions, not only of particular parts, but also over the whole body, often take place from causes not very evident. Sometimes they seem to depend on a certain delicacy or irritability of the nervous system, which is framed with such exquisite sensibility as to be strongly affected by the slightest causes. Delicate women are often subject to hysterical convulsions, and also hypochondriac people. Convulsions, however, often take their rise from wounds, irritations of the stomach and intestines by worms, poisons, violent cathartics and emetics, &c.; and very often they are symptomatic, as in dentition, the small-pox, and many kinds of fevers.

Convulsio.

Prognosis. Except in some few cases, convulsive disorders are always to be dreaded; but less in young people than in such as are advanced in life. Those which attack girls under the age of puberty, will generally cease on the appearance of the menses; and boys have likewise a chance of being relieved as they advance in life: but in grown up people, unless the cause be very evident, a cure is hardly to be expected, especially after the disease has been of long continuance.

Cure. The treatment is very much the same with that of epilepsy, afterwards to be considered: but a recovery is most frequently obtained by the removal of the existing cause.

GENUS LI. CHOREA. 284
ST VITUS'S DANCE.

Scelotyrbe, *Sauv.* gen. 136. *Sag.* 243.
Chorea, *Lin.* 139.
Scelotyrbe chorea Viti, *Sauv.* sp. 1.
Chorea St Viti, *Sydenh.* Sched. Monit.

Description. This disease shows itself first by a kind of lameness or instability of one of the legs, which the patients draw after them in a ridiculous manner: nor can they hold the arm of the same side still for a moment; for if they lay it on their breast, or any other part of their body, it is immediately forced away by a convulsive motion. If they be desirous of drinking, they use a number of odd gesticulations before they can bring the cup to their mouths, because their arms are drawn this way and that by the convulsions which affect them.

Causes, &c The general cause of St Vitus's dance is a debility of the system; and hence we find it attacks only weakly boys, and more especially girls, when under the age of puberty. But the particular causes determining the muscles to be affected in such and such a manner are entirely unknown.

Prognosis. As this disorder scarce ever attacks any persons but such as are under the age of puberty, there is almost a certain prospect of its being then cured, though generally the disorder is easily removed before that time.

Cure. See EPILEPSY.

GENUS LII. RAPHANIA. 285

Raphania, *Lin.* 155. *Vog.* 143. *Lin.* Amœn. Acad. Vol. VI.
Convulsio raphania, *Sauv.* sp. 7.
Eclampsia typhodes, *Sauv.* sp. 1. *Seunert* de febr. l. iv. cap. 16. *Gregor. Horst.* Oper. tom. II. l. viii. obs. 22. *Brunner* in Ephem. Germ. D. iii. A. ii. obs. 224. *Willisch.* ibid. cent. vii. obs. 13. *Wepfer.* de Affect Capitis, obs. 120. *Breslauer* Sammlung 1717, Julio Septembri & Decembr. Ibid. 1723, Januar. A. N. C. Vol. VII. obs. 41. *Bruckmann* Com. Norimb. 1743, p. 50.

Description. According to Sauvages, this distemper begins with a lassitude of the limbs, transient colds and shiverings, pain of the head, and anxieties of the præcordia. Then come on spasmodic startings of the fingers and feet; also of the tendons and muscles, con-

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ſpicuous below the ſkin. The diſeaſe is attended with heat, fever, delirium, ſtupor, conſtriction of the breaſt, ſuffocating dyſpnœa, loſs of voice, horrid convulſions of the limbs, preceded by a formication, or ſenſation as of ants or other ſmall inſects creeping on the parts. In this ſtate of the diſeaſe, the convulſive paroxyſms are attended with moſt violent pains in the limbs, vomiting, or diarrhœa, with the paſſing of worms, thirſt, and in young people an unnatural hunger. It continues from ten days to three months. About the eleventh or twentieth day, ſome are relieved by copious ſweats, or purple exanthemata: while others fall into a tabes, with ſtupor, or ſtiffneſs of the joints.

Cauſes, &c. This diſeaſe is frequently epidemic in Suabia and other parts of Germany; where it is ſaid to be produced by ſeeds of radiſhes, which are often mixed with rye in that country; and from this ſuppoſed cauſe the diſeaſe takes its name. It is alſo, however, a very common opinion, that this diſeaſe depends on the rye uſed in diet being of a bad quality, and particularly containing a large proportion of what is called *ſpurred rye*.

Cure. In this affection, alſo, the cure, as far as it has yet been diſcovered, is very much the ſame with that of epilepſy, the diſeaſe next to be conſidered.

286 GENUS LIII. EPILEPSIA.
FALLING-SICKNESS.

Epilepſia, *Sauv.* gen. 134. *Lin.* 143. *Vog.* 188. *Sag.* gen. 24. *Boerh.* 1071. *Hoffm.* III. 9. *Junck.* 54.
Eclampſia, *Sauv.* gen. 133. 180. *Sag.* gen. 240.

287 Sp. I. The CEREBRALIS, or *Epilepſy* depending on an affection of the *Brain*.

Epilepſia plethorica, *Sauv.* ſp. 1.
Eclampſia plethorica, *Sauv.* ſp. 7.
Epilepſia cachectica, *Sauv.* ſp. 2.

288 Sp. I. The SYMPATHICA, or *Sympathetic Epilepſy*, with a ſenſation of ſomething riſing from a certain part of the body towards the Head.

Epilepſia ſympathica, *Sauv.* ſp. 8.
Epilepſia pediſymptomatica, *Sauv.* ſp. 6.

289 Sp. II. The OCCASIONALIS, or *Epilepſy* ariſing from various irritating Cauſes.

Epilepſia traumatica, *Sauv.* ſp. 13.
Eclampſia traumatica, *Sauv.* ſp. 9.
Epilepſia a dolore, *Sauv.* ſp. 10.
Epilepſia rachialgica, *Sauv.* ſp. 14.
Eclampſia a doloribus, *Sauv.* ſp. 4.
a. Rachialgica.
b. Ab otalgia.
c. A dentitione.
Eclampſia parturientiem, *Sauv.* ſp. 3.
Eclampſia verminoſa, *Sauv.* ſp. 2.
Eclampſia ab atropa, *Sauv.* ſp. 11.
Eclampſia ab œnanthe, *Sauv.* ſp. 12.
Eclampſia a cicuta, *Sauv.* ſp. 13.
Eclampſia a coriaria, *Sauv.* ſp. 14.
Epilepſia exanthematica, *Sauv.* ſp. 11.
Epilepſia cachectica, *Sauv.* ſp. 2.
Epilepſia ſtomachica, *Sauv.* ſp. 3.
Eclampſia a ſaburra, *Sauv.* ſp. 5.
Epilepſia a pathemate, *Sauv.* ſp. 7.
Eclampſia ab inanitione, *Sauv.* ſp. 8.
Epliepſia neophytorum, *Sauv.* ſp. 15.

Epilepſia.

Deſcription. The epilepſy often attacks ſuddenly and without giving any warning: but more frequently is preceeded by a pain in the head, laſſitude, ſome diſturbance of the ſenſes, unquiet ſleep, unuſual dread, dimneſs of ſight, a noiſe in the ears, palpitation of the heart, coldneſs of the joints, and in ſome there is a ſenſation of formication, or a cold-air, &c. aſcending from the lower extremities towards the head. In the fit, the perſons fall ſuddenly to the ground (whence the name of the *falling-ſickneſs*), frequently with a violent cry. The thumbs are ſhut up cloſe in the palms of the hands, and are with difficulty taken out; the eyes are diſtorted, ſo that nothing but the whites are to be ſeen; all ſenſation is ſuſpended, inſomuch, that by no ſmell, noiſe, or otherwiſe, nor even by pinching the body, can they be brought to themſelves; they froth at the mouth, with a hiſſing kind of noiſe; the tongue is frequently lacerated by the teeth, and there is a violent convulſive motion of the arms and legs. Sometimes, however, the limbs, inſtead of being agitated by convulſive motions, are all ſtiff, and the patients are as immoveable as a ſtatue. In children the penis is erected; and in young men there is an emiſſion of the ſemen, and the urine is often thrown out to a conſiderable diſtance. At length there is a remiſſion of the ſymptoms, and the patients recover after a longer or ſhorter interval; when they complain of a pain, torpor, or heavineſs of the head, with a laſſitude of all the joints.

Cauſes, &c. The diſſection of epileptic ſubjects has ſhown a variety of morbid appearances, which may be ſuppoſed to have contributed to the diſeaſe; ſuch as indurations in the brain or meninges; carries of the internal ſurface of the cranium; projections of the boney ſubſtance of the ſame, preſſing upon the brain; collections of ſerum or purulent matter, and earthy concretions within the ſkull; beſides many others which are recorded by Bonetus, Morgagni, and Lieutaud. But often the cauſes are impoſſible to be diſcovered; for even in thoſe who have died of the diſeaſe, the brain and all other parts of the nervous ſyſtem have been apparently ſound. The diſeaſe will attack ſtrong as well as weak people; and in thoſe who are ſubject to it, any conſiderable exceſs in drinking, a ſurfeit, violent paſſion, or venery, &c. will certainly being on a fit. Some have epileptic paroxyſms returning periodically after conſiderable intervals; and the diſeaſe has been thought to have ſome dependence on the phaſes of the moon.

Prognoſis. If the epilepſy comes on before the time of puberty, there are ſome hopes of its going off at that time. But it is a bad ſign when it attacks about the 21ſt year, and ſtill worſe if the fits grow more frequent; for then the animal-functions are often deſtroyed, as well as thoſe of the mind, and the patient becomes ſtupid and fooliſh. Sometimes it will terminate in melancholy or madneſs, and ſometimes in a mortal apoplexy or palſy. It has ſometimes however, been obſerved, that epilepſies have been removed by the appearance of cutaneous diſeaſes, as the itch, ſmall-pox meaſles,

Spasmi measles, &c. While the disease is recent, therefore, we are not to despair of a cure; but if it be of long standing, or hereditary, there is very little reason to be expect that it can be removed.

Cure. From the symptoms occurring in epilepsy, which consist of involuntary convulsive motions, and an affection of the mental powers, there is reason to conclude, that the fit immediately depends on the induction of some peculiar action of the brain; but that convulsions may ensue from this cause, it would seem necessary that there should also occur a peculiar disposition to action in the moving fibres. On this ground then, we may suppose the cure to be chiefly expected on one of two principles; either by our being able to prevent the peculiar action of the brain, or to remove the disposition to action in the moving fibres. The first is chiefly to be acomplished by the removal of irritating causes, by preventing their influence from being propagated to the brain, when they are applied to remote parts; or by counteracting their influence, from inducing in the brain a state of action different from that to which they give rise. The second end is chiefly to be obtained by diminishing the mobility of the nervous energy, and by strengthening the tone of the moving fibres. It must, however, be allowed, that in all convulsive disorders, excepting those which are cured by nature about the time of puberty, the cure by artificial means is very difficult. Numberless specifics have been recommended, but all of them have failed of answering the expectation. When the cause can be discovered, that must be removed. In other cases, the cold bath, valerian root, castor, musk, opium, the fœtid gums, Peruvian bark, with the whole tribe of nervous and antispasmodic medicines, have been recommended: but none of these, or indeed any combination of them, have been found generally useful; though the slighter, or symptomatic cases, may often be removed by them.

Of late the *calx*, improperly called the *flowers*, of zinc, have obtained such reputation in convulsive disorders as to be received into the Edinburgh Pharmacopœia under the title of *zincum ustum*. They were proposed by Dr Gaubius as an antispasmodic, in his *Adversaria;* and their efficacy has since been confirmed by various observations. In an inaugural dissertation published by Dr Hart at Leyden, the medical virtues of the flowers of zinc are considered. He observes, that they have long been used externally, chiefly for inflammations of the eyes from acrid lymph. Glauber first proposed the internal use of them; and Gaubius discovered them to be the remedy of a celebrated empiric Luddemannus, which he styled his *luna fixata*. After this he exhibited them with success in convulsive and spasmodic diseases. Dr Hart supposes, that they act either as absorbents, or as possessing a specific virtue: but is a strong advocate for their efficacy, on whatever principles they may operate; and, in favour of his opinion, relates seven cases in which they proved successful. A girl of 17 years of age, was seized with a slight *chorea* from a fright; and when the disease had continued six days, she began to take the flowers of zinc, by which her disorder was removed in less than three weeks. Her cure required only 16 grains of the calx. In a few months the complaints returned, from the same cause; and were removed by four grains of the medicine divided into ten doses.—A boy of about four years old, labouring under a real epilepsy, suspected to be hereditary, was cured by a grain of the flowers of zinc taken every day for some time.—A man 50 years old, thrown into convulsions from a violent passion, was cured by a grain of the calx taken every two hours. The disease had gone off upon venesection and the use of some other remedies; but returned again in two weeks, when it was finally removed by the zinc. The two last cases are related from Dr Gaubius, who affirms that he has used the flowers of zinc in cases of the chincough, hysteric hiccough, and spasmus cynicus; that they frequently did more than other medicines, but were by no means successful in every case. The other cures mentioned by Dr Hart are similar to those abovementioned. But it does not appear that he ever saw a confirmed epilepsy cured by this medicine. Epilepsia.

In the first volume of *Edinburgh Medical Commentaries*, we have an account by Mr Benjamin Bell, of a man afflicted with a confirmed epilepsy, who was considerably relieved by the flowers of zinc. He was about 35 years of age, and had been subject to the disease for 10 yeass. At first the paroxysms did not return oftener than once a month; but becoming gradually more frequent, they came at last to be in a manner continual, insomuch that he would have ten, eleven, or twelve attacks in a day, and very seldom had an interval of 24 hours. His memory and judgment were so much impaired, that he could scarce answer a question distinctly. He had used a great variety of medicines without any benefit. About three years before applying to Mr Bell, he had violent rheumatic pains in his limbs, which left such an extreme debility that he was never afterwards able to get out of bed without the assistance of two or three people.

On the 22d of October 1772, Mr Bell found him in the abovementioned condition, and prescribed as follows:

R. *Flor. Zinc.* gr. xxiv.
Ext. Gent. ʒi. M. f. mass. et divid. in pill. xxiv. cap. 1. m. & v.

He continued to take two pills a-day till the first of November, without any sensible benefit. The dose was then doubled, and continued till the 12th; when the fits, though equally violent, became less frequent. The medicine was gradually augmented to ten pills thrice a-day; and the consequence was, that his memory and understanding returned, the fits became much slighter and less frequently repeated, though the disease could not be radically subdued.

In a young man labouring under the epilepsy, in whom the fits were preceded by an *aura epileptica*, or sensation like air arising from the inside of the knee-joint, the disease was also relieved, but not cured.

Dr Percival relates some cases of epilepsy which seem to have been cured by the flowers of zinc; and in other cases, where the disease was not entirely removed by it, the spasms were nevertheless much mitigated. He did not observe that it promoted any evacuation; excepting that in some, upon being first taken, it occasioned a little sickness, which went off with a stool. He adds, that those apothecaries who do not prepare this

this medicine themselves, are in great danger of being imposed upon, as it is sometimes a mere corrosion of the zinc by an acid, and even imperfectly washed.

The good effects of calcined zinc as an antispasmodic are also attested by Dr Haygarth of Chester and Dr White of York. The former gives a test of their goodness which may be of use to those who do not prepare them, namely, that the true flowers of zinc, when strongly heated, become yellow, but reassume their white colour on being allowed to cool. The latter gives a case of heiranosos, or strange convulsions of almost all the muscles of the body, cured by zinc, after a number of other remedies had failed. The patient, however, had been formerly much relieved by Ward's antimonial pill.

In Dr Home's clinical experiments and histories, also calcined zinc is mentioned as having been found serviceable upon trial in the Royal Infirmary of Edinburgh. Of the other principal remedies which have been recommended for the epilepsy and other convulsive disorders allied to it, we have the following account by the same author.

1. *The cold-bath* was tried in one who had a convulsive disorder of one side, but the symptoms were rendered much worse by it,

2. *Venesection*. Not to be depended on in convulsions.

3. *Electricity*. In two convulsive cases was of no service.

4. *Epispastics*. Do not seem to be powerful antispasmodics.

5. *Valerian*. In nine convulsive cases, for which this remedy hath been reckoned almost a specific, it not only made no cure, but could scarcely be reckoned to do any good. Dr Home supposes that it acts as a bitter tonic, something like the *serpentaria Virginiana*. Though much used at present, he tells us it has always appeared to him a weak, often a hurtful, medicine.

6. *Musk*. Six convulsive patients treated with large doses of this remedy, were neither cured nor in the least relieved.

7. *Castor* seems to be unworthy of the confidence formerly put in it. It is indeed possessed of a sedative power, and therefore may be useful in spasmodic feverish cases.

8. *Asafœtida* has considerable antispasmodic powers, but is not always successful. It heats and quickens the pulse; and is therefore improper in cases attended with inflammation. It disagrees with some from a peculiarity of constitution; exciting pain in the stomach, and vomiting; but this can be known only after the exhibition of the medicine.

9. *Cortex Peruvianus*. Of seven spasmodic cases, six were either cured or mitigated. An epilepsy of eight years standing was very much relieved by taking the bark for a month, and one of two years standing by taking it for ten days. But the medicine is of a heating nature, and therefore is not to be employed in cases attended with inflammatory symptoms.

10. *Peony root* was given two epileptic patients without the least success.

11. *Viscus quercinus*, or mistletoe, was given in the quantity of two scruples five times a-day to an epileptic patient, without success.

12. *Extractum hyosciami* was given to an epileptic patient, to one afflicted with the hemitotonos, and to one who laboured under the hysteric affection, without the least good effect.

3. *Folia aurantiorum* were exhibited with the like bad success. Five drachms of the powdered leaves were taken at once without any sensible effect.

14. *Cardamine pratensis*, in three epileptic cases, was not attended with any success.

15. *Opium* did no good.

16. *Cuprum ammoniacale* made no cure in four cases of epilepsy in which it was tried.

That in many cases all these remedies have been employed without success, is not to be denied: and indeed it may with confidence be asserted, that a great majority of cases of epilepsy are incurable by any remedy that has yet been discovered. At the same time, as there is incontrovertible evidence that some of them have succeeded at least in certain cases, the more powerful may always be considered as deserving a fair trial. The cuprum ammoniacum, in particular, seems well intitled to the attention of practitioners; for though it be a medicine of great activity, yet under prudent administration it may be employed even with very young subjects without any hazard; and in several inveterate cases, which had obstinately resisted other medicines, it has brought about a complete recovery.

Genus LIV. PALPITATIO. 290

Palpitation *of the* Heart.

Palpatio, *Sauv.* gen. 130. *Lin.* 132 *Vog.* 213. *Sag.* 237. *Hoffm.* III. 83. *Junck.* 33.

The palpitation of the heart is sometimes so violent, that it may be heard at a considerable distance. It may proceed from a bad confomation of the heart itself, or some of the large vessels. It may also be occasioned by wounds or abscesses in the heart; or it may proceed from polypous concretions or ossifications of that viscus, or from plethora, fear, or spasmodic affections of the nervous system. When it proceeds from diseases of the heart or large vessels, it is absolutely incurable. In spasmodic cases, the remedies above related may be used. If the patient be plethoric, bleeding will probably remove the disorder, at least for the present.

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Asthma, *Sauv.* gen. 145. *Lin.* 161. *Vog.* 268. *Sag.* gen. 282.

Asthma convulsivum, et spasmodico-flatulentum, *Hoffm.* III. 94.

Asthma spasticum, *Junck.* tab. 51.

Sp. I. *Spontaneous* Asthma.

Asthma humidum, *Sauv.* sp. 1. Flatulentum, *Floyer* on the Asthma, chap. i.

Asthma convulsivum, *Sauv.* sp. 2. *Willis* Pharm. rat. P. II. sect. i. cap. 12.

Asthma hystericum, *Sauv.* sp. 3. *Floyer* on the Asthma, chap. i.

Asthma stomachicum, *Sauv.* sp. 8. *Floyer*, Scheme of the species of Asthma. Periodic Asthma 6.

Orthopnœa spasmodica, *Sauv.* sp. 3.

Orthopnœa hysterica, *Sauv.* sp. 4.

Sp. II. The *Exanthematic* Asthma.

Asthma exanthematicum, *Sauv.* sp. 11.

Asthma cachecticum, *Sauv.* sp. 13.

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Sp. III. The *Plethoric* ASTHMA.

Asthma plethoricum. *Sauv.* sp. 15.

THE asthma is a chronic disease, which may continue to give very great distress, at intervals, for a considerable number of years. Sir John Floyer, when he wrote his celebrated treatise, had laboured under repeated paroxysms for 30 years.

The common distinction is into *humid* and *dry*; the former is accompanied with an expectoration of mucus or purulent matter, but the latter is not. In the genuine humoral asthma, the patients are obliged to lean forward; the inspiration is short and spasmodic; and the expiration very slow.

Asthmatic persons have generally some warning of the attack, from a languor, loss of appetite, oppression, and swelling of the stomach from flatulence, which precede the fit; but it is usually in the middle of the night that the violent difficulty of breathing comes on.

The duration of the paroxysm is uncertain, as it will sometimes terminate in three or four hours, while at other times it shall continue for as many days; nay, it has been known to last three weeks without intermission. While it subsists, the patient is in very great distress, not being able to lie in bed, nor scarcely to speak or expectorate, so great is the difficulty of breathing; and yet, notwithstanding all this apparent interruption to the free passage of the blood through the lungs, an inflammation here seldom or never supervenes a fit of the asthma. As the paroxysm wears off, and the breathing becomes free, there is more or less of an expectoration of mucus; and the urine, from being pale and limpid becomes high-coloured, and lets fall a copious sediment.

In order to obtain relief in the fit, we must sometimes bleed, unless extreme weakness or old age should forbid, and repeat it according to the degrees of strength and fullness: a purging clyster, with a solution of asafœtida, must be immediately injected; and if the violence of the symptoms should not speedily abate, it will be proper to apply a blistering plaster to the neck or breast.

In the height of the paroxysm, an emetic might be followed by dangerous symptoms, as it would increase the accumulation of blood in the vessels of the head; but vomiting will often prevent a fit of the asthma, especially if the stomach should chance to be loaded with any sort of saburra. A very strong infusion of roasted coffee has been found to give ease in an asthmatic paroxysm.

Sir John Pringle says it is the best abater of the paroxysms of the periodic asthma that he has seen. The coffee ought to be of the best Mocco, newly burnt, and made very strong immediately after grinding it. He commonly ordered an ounce for one dish; which is to be repeated fresh after the interval of a quarter or half an hour; and which is to be taken without milk or sugar. The medicine in general is mentioned by Musgrave in his treatise *de Arthritide anomala*; but he first heard of it from a physician in Litchfield, who had been informed by the old people of that place, that Sir John Floyer, during the latter part of his life, kept free from, or at least livid easy under, his asthma, from the use of very strong coffee. This discovery, it seems, he made after the publication of his book upon that disease. Dr Percival says he has frequently directed coffee in the asthma with great success.

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In the intervals of the fits, persons subject to the asthma, especially the humid species, should take emetics from time to time. An infusion of tobacco is an emetic that has been said to be very serviceable in some asthmatic cases; but its operation is both so distressing and so dangerous, that it will never probably be introduced into common use as an emetic; and smoking or chewing the same has been known to prevent the frequency and severity of the paroxysms. Asthmatic patients may also use the *lac ammoniaci* with a due proportion of *oxymel scilliticum* and *vinum antimoniale*, with a view to promote expectoration; or the gum ammoniac, and others of similar virtues, may be formed into pills and combined with soap as mentioned for the dyspnœa pytuitosa; or a mass may be composed of asafœtida and balsam of Tolu, with syrup of garlic; and these pills may be washed down by a medicated wine, impregnated with squills, horse-radish root, and mustard-seed; or a strong bitter infusion, with a little antimonial wine.

In some cases crude mercury will be found serviceable; in others flowers of sulphur, made into an electuary with honey or syrup of garlick; and if, notwithstanding the use of these things, a costive habit should prevail, it will be necessary, from time to time, to give a few grains of pills of aloes and myrrh, soap and aloes, or a mass of equal parts of rhubarb, scammony, and soap.

The *dry* or *spasmodic asthma*, during the extreme violence of the fit, is best relieved by opiates; and sometimes very large doses are required. But in order to obtain permanent relief, nothing is found to answer better than ipecacuanha in small doses. Three, five, eight, or ten grains, according to the strength and constitution of the patient, given every other day, have been productive of the happiest effects; acting sometimes as an evacuant, pumping up the viscid phlegm; at others, as an antispasmodic or sedative. Issues are generally recommended in both species, and will often be found useful.

Changes of weather are usually felt very sensibily by asthmatic people, who in general cannot live with tolerable ease in the atmosphere of large cities; though we shall sometimes meet with patients who agree better with this air, which is so replete with gross effluvia of various kinds, than with the purest that can be found in country situations. And some are found who breathe with the most ease in a crowded room, with a fire and candles.

A light diet of meats that are easy of digestion, and not flatulent, is requisite for asthmatic people; and the exercise of riding is indispensibly necessary.

When the asthma is found to depend on some other disease, whether it be the gout or an intermittent fever, or when it proceeds from the striking in of some cutaneous eruption, regard must always be had to the primary disease: thus, in the *asthma arthriticum*, sinapisms to the feet, or blistering, will be absolutely necessary, in order, if possible, to bring on a fit of the gout. And when the dregs of an ague give rise to an asthma, which is termed *febriculosum*, and invades at regular intervals, we must have recourse to the Peru-

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vian bark. The *asthma exanthematicum* will require blisters or issues, to give vent to the acrid matter which were repelled from the surface of the body; and courses of sulphureous waters, goat's whey, and sweetening diet-drinks, or perhaps mercurial alteratives in order to correct the sharpness of the juices.

292 GENUS LVI. DYSPNŒA.
Habitual DIFFICULTY of BREATHING.

Dyspnœa, *Sauv.* gen. 144. *Lin.* 160. *Vog.* 267. *Sag.* 251. *Junck.* 32.

293 Sp. I. The *Catarrhal* DYSPNOEA.

Asthma catarrhale, *Sauv.* sp. 16.
Asthma pneumonicum, *Willis* Pharm. rat. P. II. sect. i. cap. 12.
Asthma pituitosum, *Hoffm.* III. sect. ii. cap. 2. § 3.
Asthma pneumodes, *Sauv.* sp. 17.

This is readily known by the symptoms of pneumonia and catarrh attending it, and to the removal of these symptoms the care of the physician must be principally directed.

294 Sp. II. The *Dry* DYSPNOEA.

Dyspnœa a tuberculis, a hydatibus, &c. *Sauv.* sp 2. 4. 5. 20.
Orthopnœa a lipomate, *Sauv.* sp 18.

This is generally accompanied with a phthisis pulmonalis; but Sauvages mentions one species of phthisis to which the dry dyspnœa seems more particularly to belong. The patients fall away by degrees, and have a great difficulty of breathing, continual thirst, and little or no spitting. When opened after death their lungs are found not to be ulcerated, but shrivelled and contracted as if they had been smoke-dried. Goldsmiths and chemists are said to be subject to this disease by reason of the vapours they draw in with their breath. Sauvages doth not mention any particular remedy. Shortness of breath arising from *tubercles*, as they are termed, or a scirrhous enlargement of the lymphatic glands which are dispersed through the lungs, is commonly found in scrofulous habits, and may be distinguished by the concomitancy of those external swellings and appearances which particularly mark the scrofula. This species of dyspnœa generally ends in a phthisis. Courses of goat's whey, and of tea-water, have been known to do service; but it must be confessed, that a perfect cure is seldom obtained. Issues are of use in these cases, as they appear to prevent the ill effects of an over fullness, if it should happen at any time to supervene.

295 Sp. III. DYSPNOEA from *Changes* in the *Weather*. (*Sauv.* sp. 12.)

This seems to be a disease entirely spasmodic, and the antispasmodics already related are accordingly indicated.

296 Sp. IV. The DYSPNOEA from *Earthy Substances* formed in the *Lungs*.

Sauvages mentions this disease as much more common in brutes than in the human race; but Dr Cullen mentions his having seen some instances of it; and we have several accounts by different authers of calculous matters being coughed up by people labouring under a dyspnœa, and threatened with consumption. In three cases of this kind which fell under Dr Cullen's inspection, there was no appearance of earthy or stony concretions in any other part of the body. The calcareous matter was coughed up frequently with a little blood, sometimes with mucus only, and sometimes with pus. In one of these cases, an exquisite phthisis came on, and proved mortal: in the other two the symptoms of phthisis were never fully formed; and after some time, merely by a milk diet and avoiding irritation, the patients entirely recovered.

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Sauvages also greatly recommends milk in these cases, and soap for dissolving the concretions. The reason why brutes are more subject to these pulmonary calculi than mankind, is, that they very seldom cough, and thus the stagnating mucus of lymph concretes into a kind of gypseous matter.

Sp. V. The *Watery* DYSPNOEA. 297

Dyspnœa pituitosa, *Sauv* sp. 1.
Orthopnœa ab hydropneumonia, *Sauv* sp. 12.

This may arise from too great a defluxion of mucus on the lungs, or from an effusion of serum, as is mentioned under the pneumonia.. The treatment of the disease may be gathered from what has been already said under the heads of peneumonia, catarrh, empyema, &c.

Sp. VI. The DYSPNOEA from *Corpulency*. 298

Othopnœa a pinguedine, *Sauv.* sp. 6.

There have been many instances of suffocation and death occasioned by too great corpulency. These fatal effects, however, may be almost always avoided if the persons have resolution to persist in an active and very temperate course of life; avoiding animal food, much sleep, and using a great deal of exercise. In the third volume of the Medical observations, however, there is an extraordinary instance of internal obesity which neither showed itself externally, nor could be removed by any medicines.

Other species of dyspœna have been considered under PHTHISIS. It is frequently symptomatic of diseases of the heart and large vessels, or swellings of the abdomen, &c.

GENUS LVII. PERTUSSIS. 299
CHINCOUGH.

Pertussis *Sydenham*, Ed. Leid. p. 200. 311. 312. *Huxham*, de aere, ad. ann. 1732.
Tussis convulsiva, sive ferina, *Hoffm.* III. 111.
Tussis ferina, *Sauv.* sp. 10. *Sag.* sp. 10.
Tussis convulsiva, *Sauv.* sp. 11. *Sag.* sp. 11.
Amphimerina tussiculosa, *Sauv.* sp. 13.

Description. This disease comes on at first like a common cold; but is from the beginning attended with a greater degree of dyspnœa than is common in catarrh; and there is a remarkable affection of the eyes, as if they were swelled, and a little pushed out of their sockets. By degrees the fits of coughing become longer and more violent, till at last they are plainly convulsive, so that for a considerable time the patient cannot respire, and when at last he recovers his breath, inspiration is performed with a shrill kind of noise like the

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the crowing of a cock. This kind of inspiration serves only as an introduction to another convulsive fit of coughing, which is in like manner followed by another inspiration of the same kind; and thus it continues for some time, very often till the patient vomit, which puts an end to the paroxysm at that time. These paroxysms are attended with a violent determination of the blood towards the head, so that the vessels become extremely turgid, and blood not unfrequently flows from the mouth and nose. The disease is tedious, and often continues for many months. It is not commonly attended with fever.

Causes, &c. The chincough is an infectious disorder, and very often epidemic: but the nature of the contagion is not understood; at least it is no farther understood than that of small-pox, measles, or similar epidemics. We well know that it is from a peculiar and specific contagion alone that this disease, as well as the others abovementioned, can arise. But with regard to the nature of any of them, we are totally in the dark. It generally attacks children, or adults of a lax habit, making its attack frequently in the spring or autumn; at the same time, when this contagion is introduced into any town, village, or neighbourhood, it will rage epidemically at any season. Those alone are affected with this disease who have never before been subjected to it. For in this affection, as well as in small-pox, having had the disease once, gives defence against future contagion. Every individual, however, does not seem to be equally readily affected with this contagion; like other contagious diseases occurring only once in a lifetime, it may naturally be expected to be more frequent among children than at any other period of life. But many, though frequently exposed to contagion, are yet not affected with the disease: and those children who live upon unwholesome watery food, or breathe unwholesome air, are most liable to its attacks, and suffer most from them. In general it has been concluded, that whatever weakens the solids, or tends to bring on a dissolution of the fluids, predisposes to this disease.

Prognosis. The chincough is not very often fatal. During one epidemic, however, it is often observed to be much more dangerous and more severe than during another. This is also remarked with regard even to particular periods of the same epidemic; and it is also observed, that on certain families this disease is much more severe than on others. Its danger, however, is still more connected with the period of life at which it occurs. In children under two years of age it is most dangerous; and kills them by producing convulsions, suffocation, inflammation and suppuration of the brain or in the lungs, ruptures, and incurvation of the spine. In pregnant women it will produce abortion; and in adults inflammations of the lungs, and all the consequences of pneumonia, more frequently than in children. From a long continuance of the disease patients will become asthmatic, ricketty, and scrofulous. It is generally reckoned a good sign when a fit terminates by vomiting; for in this disease there seems to be a great increase of the secretion of mucus, and the vomiting affords great relief.

Cure. Pertussis is one of those diseases which after the contagion has exerted its influence can be terminated only by running a certain course: but it is much less limited in its course than small-pox and measles, and often it runs on to a very great length, or at least it is very difficult to distinguish certain sequelæ of this disease from the disease itself. And when it exists in the former of these states, it admits of an artificial termination. In the treatment of this affection, therefore, the objects at which a practitioner chiefly aims, are in the first place, the obviating urgent symptoms, and forwarding the natural termination of the disease; and secondly, the inducing an artificial termination. With these intentions various practices are employed on different occasions. The most approved remedies are vomits, purges, bleeding, and the attenuating pectorals; for the other kinds generally do hurt: but large evacuations of any kind are pernicious. In the Medical Observations, Vol. III. Dr Morris recommends castor and the bark; but in cases attended with any degree of inflammation, the latter must certainly do hurt, and the former will generally be insignificant. Dr Butter, in a dissertation expressly on the subject, relates 20 cases of it cured by the extract of hemlock. He directs half a grain a-day for a child under six months old; one grain for a child from six months to two years; afterwards allowing half a grain for every year of the patient's age till he be 20: beyond that period, he directs ten grains to be given for the first day's consumption, gradually increasing the dose according to the effect. If the patient have not two stools a-day, he advises magnesia or the *lixivia vitriolata sulphurea* to be added to the hemloek mixture. By this method he says the peculiar symptoms of the disease are removed in the space of a week; nothing but a slight cough remaining. The use of hemlock, however, has by no means become universal in consequence of this publication, nor indeed has this remedy been found equally successful with others who have given it a fair trial. The remedy most to be depended upon in this disease is change of air. The patient, as soon as the disease is fully formed, ought to be removed to some other part of the country: but there is no occasion for going to a distant place; a mile or two, or frequently a smaller distance, will be sufficient; and in this new habitation, the frequency of the cough is almost instantly diminished to a most surprising degree. After remaining there for some time, however, the cough will often be observed to become again more frequent, and the other syptoms increased. In this case, another change of air, or even a return to the former habitation, becomes necessary. Manifest benefit has even been derived by changing a patient from one room of a house to another. But although change of air has thus been advantageous, it must also be remarked, that when it has been had recourse to at very early periods it has often done mischief, particularly by aggravating the febrile and inflammatory symptoms. If the disease be attended with fever, bleeding and other antiphlogistic remedies are proper. Dr Buchan recommends an ointment made of equal parts of garlic and hog's lard applied to the soles of the feet; but if it have any effect, it is probably merely as an *emplastrum calidum*. It ought to be put on a rag and applied like a plaster. Opiates may sometimes be

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be useful, but in general are to be avoided. They are chiefly serviceable where the cough is very frequent, with little expectoration. In these cases benefit has sometimes also been derived from vitriolic ether, and sometimes from the tincture of cantharides. An almost instantaneous termination has on some occasions been put to this disease by exciting a high degree of fear, or by inducing another febrile contagion: But the effects of both are too uncertain and too dangerous to be employed in practice.

300 GENUS LVIII. PYROSIS.
The HEART-BURN.

Pyrosis, *Sauv.* gen. 200. *Sag.* 158.
Soda, *Lin.* 47. *Vog.* 154.
Scotis, the WATER-BRASH.
Pyrosis Suecica, *Sauv.* sp. 4.
Cardialgia sputatoria, *Sauv.* sp. 5.

This disease, whether considered as primary or symptomatic, has already been fully treated under DYSPEPSIA.

301 GENUS LIX. COLICA.
The COLIC.

Colica, *Sauv.* gen. 204. *Lin.* 50. *Vog.* 160. *Sag.* 162. *Junck.* 106.
Colica spasmodica et flatulenta, *Hoffm.* II. 284.
Rachialgia, *Sauv.* gen. 211. *Sag.* 168.
Ileus, *Sauv.* gen. 252. *Vog.* 162. *Sag.* gen. 187.
Iliaca, *Lin.* 185.
Dolor et spasmus iliacus, *Hoffm.* II. 263.
Passio iliaca, *Junck.* 107.

302 Sp. I. *The Spasmodic* COLIC.

Colica flatulenta, pituitosa, &c. *Sauv.* sp. 1. 2. 5. 6. 7. Ileus physodes, volvulus, inflammatorius, &c. *Ejusd.* sp. 1. 3. 5. 7. 8. 9.

Description. The colic is chiefly known by a violent pain in the abdomen, commonly about the umbilical region. The pain resembles various kinds of sensations, as of burning, twisting, boring, a ligature drawn very tight, &c. The belly is generally costive, though sometimes there is a violent evacuation of bilious matters upwards and downwards. In these cases the disease is sometimes accompanied from the beginning with a weak and intermitting pulse, cold sweats, and fainting. In some the disease comes on gradually, beginning with an habitual costiveness; and if purgatives be taken, they do not operate. The pain comes on generally after a meal, and soon occasions nausea and vomiting. Sometimes the disease is attended with pyrexia, violent thirst, and a full pulse; the vomiting becomes more violent, and excrementitious matters are thrown up with most exquisite pain and tension of the abdomen; an hickup comes on, which continues obstinately; till at last a cessation of pain and fetid breath indicate a mortification of the intestines and approaching death. Sometimes the peristaltic motion of the intestines is so totally inverted, that all their contents are evacuated by the mouth, and even clysters will be vomited; which constitutes that disease commonly called the *iliac passion*.

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Causes, &c. Colics may arise from any sudden check given to perspiration, as by violent cold applied to any part of the body, especially to the lower extremities and abdomen. Very frequently they are occasioned by austere, acid, or indigestible aliments taken into the stomach. By any of these, a violent colic, or indeed an iliac passion, may be occasioned; for Dr Cullen justly observes, that this last, though commonly accounted a different species of disease, differs from a colic in no other way than in being in every respect in a much higher degree. In those who have died of this disease and been dissected, the intestines have sometimes been found twisted; but more commonly there hath been an *introsusception* of the intestine, that is, one part of the gut seems to have entered within the other. In the Edinburgh Medical Essays, Vol. III. we have a dissertation on the use of the warm bath in the bilious colic, in which the author derives the disorder from a spasmodic constriction of the intestine occasioned by the acrimony of the bile. By this, he says, the intestine is not only contracted into an unusual narrowness, but coats of it have been found, upon dissection, so closely joined, that no passage could be made downwards more than if they had been strongly tied by a ligature. The formation of the *introsusceptio* he explains by quoting a passage from Peyerus, who made the following experiment on a frog. Having irritated the intestine of the animal in several different places, he observed it to contract at those places most violently, and to protrude its contents upwards and downwards wherever the relaxed state of the part would permit; by which means the contents were heaped together in different parts. Hence some parts of the intestine being dilated much more than enough, by reason of the great quantity of matter thrown into them, formed a kind of sack which readily received the constricted part into it. If this happen in the human body, there is the greatest danger of a mortification; because the part which is constricted, and at any rate disposed to inflammation, has that disposition very much increased by its confinement within the other, and by the pressure of the contents of the alimentary canal from the stomach downwards upon it. An iliac passion may also arise from the strangulation of part of the intestine in a hernia; and even a very small portion of it thus strangulated may occasion a fatal disease. In the Medical Observations, Vol. IV. however, we have an acount of an iliac passion arising from a very different cause, which could neither have been suspected nor cured by any other way than the operation of *gastrotomy*, or opening the abdomen of the patient, in order to remove the cause of the disorder. The patient a woman of about 28 years of age, died after suffering extreme torture for six days. The body being opened, some quantity of a dirty coloured fluid was found in the cavity of the abdomen. The jejunum and ileum were greatly distended with air. A portion of the omentum, adhered to the mesentery, near that part where the ileum terminates in the cæcum. From this adhesion, which was close to the spine, there ran a ligamentous cord or process about two inches and a half long, unequally thick, in some places not thicker than a packthread; which by its other extremity adhered to the coats of the ileum, about two inches

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inches above the cæcum. This cord formed a circle with the mesentery, large enough to admit a hen's egg to pass through it. The chord had formed a noose (in a manner difficult to be explained), which included a doubling of about two inches of the lower end of the ileum; and was drawn so tight, that it not only put a stop to the passage of every thing through the bowels and brought on a gangrene of the strangulated part, but it had even cut through all the coats of the intestine on the opposite side to the mesentery, and made an aperture about an inch long. In the Memoirs of the Academy of Surgery are mentioned several similar cases.

Prognosis. The colic is never to be reckoned void of danger, as it may unexpectedly terminate in an inflammation and gangrene of the intestines. Those species of it which are attended with purging must be considered as much less dangerous than those in which the vomiting is very violent. The iliac passion, or that attended with the vomiting of feces, is always to be accounted highly dangerous; but if the passage through the intestines be free, even though their peristaltic motion should be inverted, and clysters evacuated by the mouth, there is much more hope of a cure, than when the belly is obstinately costive, and there is some fixed obstruction which seems to bid defiance to all remedies.

Cure. In the cure of the spasmodic colic, the recovery must ultimately depend on producing a resolution of the spasmodic affection. In order to accomplish this, it is in general necessary to evacuate the contents of the intestines, and to remove morbid irritability existing in that part of the system. But in order to preserve the life of the patient from the most imminent hazard, it is still more necessary to prevent and remove those inflammatory affections which often occur in this disease. As the chief danger in colics arises from an inflammation and consequent mortification of the intestines, it is essentially necessary, in the first place, to diminish the tendency to a pyrexia, if there should happen to be any. This is accomplished by bleeding, emollient injections, warm bathing, and cooling medicines taken inwardly. Dr Porter, in the essay abovementioned, strongly recommends the warm bath in those colics attended with violent evacuations of bile. He supposes it to do service by relaxing the constriction of the intestines, and thus preventing or removing the introsusceptio. In the mean time opiates may be given to ease the pain, while every method is tried, by cathartics and glysters of various kinds, to procure a stool. In obstinate cases, where stimulating cathartics have proved ineffectual, the milder kinds, such as manna, senna, oleum ricini, &c. will succeed; but where every thing of this kind fails, recourse must be had to some of the more extraordinary methods. Some have recommended the swallowing of leaden bullets, on a supposition that by their weight they would force through the obstruction into the gut; but these seem much more likely to create than to remove an obstruction. It is impossible they can act by their gravity, because the intestines do not lie in a straight line from the pylorus to the anus; and though this were actually the case, we cannot suppose that the weight of a leaden bullet could prove very efficacious in removing either a spasmodic constriction or an obstruction from any other cause. But when we consider, not only that the intestines consist of a great multitude of folds but that their peristaltic motion (by which only the contents are forced through them) is inverted, the futility of this remedy must be evident. It might rather be supposed to aggravate the disease; as the lead, by its pressure would tend to fix the introsusception more firmly, or perhaps push it still further on. The same thing may be said of quicksilver: not to mention the pernicious consequences to be apprehended from swallowing large quantities of this mineral, even if it should prove efficacious in relieving the patient for the present. There are, however, some late cases on record, particularly one by Mr William Perry, published in the sixteenth volume of the Edinburgh Medical Commentaries, in which the hydrargyrus, swallowed in great quantities, was attended with the happiest effects after every other remedy had been tried in vain. Another method has been proposed, in the Medical Essays, for relieving the miserable patients in this disorder, which in many cases has been known to do service. The patient is to be taken out of bed, and made to walk about on the cold floor of a damp apartment. At the same time, porringers of cold water are to be dashed on his feet, legs, and thighs; and this must be continued for an hour or longer, if a stool be not procured before that time, though this will generally be the case much sooner. The exercise does not at all impair the patient's strength, but rather adds to it; and some very remarkable instances are adduced in the 6th volume of the Medical Essays, where this proved effectual after all other medicines had failed. In one person the disease had come on with an habitual costiveness, and he had been for a week tormented with the most violent pain and vomiting, which could be stopped neither by anodynes nor any other medicines, the sharpest clysters being returned unaltered, and all kinds of purgatives thrown up soon after they were swallowed; but by the abovementioned method, a stool was procured in 35 minutes, and the patient recovered. In some others the costiveness had continued for a much longer time.—Other remedies are, the blowing air into the intestines by means of a bellows, and the injecting clysters of the smoke of tobacco. But neither of these seem very capable of removing the disease. They can affect only the parts below the obstruction; while, to cure the disease, it is necessary that the obstructed parts themselves should be reached by the medicine, and therefore we have not many well-attested instances of their success. In some obstinate cases, however, benefit has certainly been derived from tobacco-smoke injections, and likewise from injections of tepid water to the extent of several pounds. For putting in practice these modes of cure a particular apparatus have been contrived; and in cases even apparently desperate, neither should be neglected. The cold water gives a general and very considerable shock to the system, checks the perspiration, and thus drives the humors inward upon the intestines, by which they receive a much more effectual stimulus than can be supposed to arise from any kind of clyster. But when all methods have failed, the only chance the patient can have for life is by a manual operation.

Colica.

In those colics which are attended with faintings,

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&c. from the beginning, and which generally attack hysteric women and other debilitated persons, all kinds of evacuations are pernicious; and the cure is to be attempted by anodynes and cordials, which will seldom fail of success. Even there also, however, it is necessary that the belly should be moved; and for this purpose injections, containing a solution of asafœtida, which operate powerfully as antispasmodics, are preferable to most other modes of cure.

303 Sp. II. Colica Pictonum. *The Colic of Poictou.*

Rachialgia Pictonum, *Sauv.* sp. 1.
Rachialgia metallica, *Sauv.* sp. 3.
Colica Pictonum *Citesii et succedentium auctorum.*

Another cause to which violent colics are frequently to be ascribed, and which often gives occasion to them where it is very little suspected, is lead, or some solution or fume of it, received into the body. To this cause is evidently owing the colics to which plumbers, lead-miners, and smelters of lead, are subject. To the same cause, though not so apparent at first sight, are we to ascribe the Devonshire colic, where lead is received into the body dissolved in cyder, the common drink of the inhabitants of that country. This has been proved by experiment; for lead has been extracted from cyder in quantity sufficient to produce pernicious effects on the human body. The colic of Poictou and what is called the *dry belly-ache* in the West Indies, are of the same nature; for which reason we give the following general description of the symptoms of all these diseases.

The patient is generally first seized with an acute pain at the pit of the stomach, which extends itself down with griping pains to the bowels. Soon after there is a distension, as with wind; and frequent reachings to vomit, without bringing up any thing but small quantities of bile and phlegm. An obstinate costiveness follows, yet sometimes attended with a tenesmus, and the bowels seem to the patient as if they were drawn up towards the back; at other times they are drawn into hard lumps, or hard rolls, which are plainly perceptible to the hand on the belly, by strong convulsive spasms. Sometimes the coats of the intestines seem to be drawn up from the anus and down from the pylorus towards the navel. When a stool is procured by artificial means, as clysters, &c. the feces appear in little hard knots like sheep's dung, called *scybala*, and are in small quantity. There is, however, usually an obstinate costiveness; the urine is discharged in small quantity, frequently with pain and much difficulty. The pulse is generally low, though sometimes a little quickened by the violence of the pain; but inflammatory symptoms very seldom occur. The extremities are often cold, and sometimes the violence of the pain causes cold clammy sweats and fainting. The mind is generally much affected, and the spirits are sunk. The disease is often tedious especially if improperly treated, insomuch that the patients will continue in this miserable state for twenty or thirty days successively; nay, instances have been known of its continuing for six months. In this case the pains at last become almost intolerable: the patient's breath acquires a strong fetid smell like excrements, from a retention of the feces, and an absorption of the putrid effluvia from them by the lacteals. At last, when the pain in the bowels begins to abate, a pain comes on in the shoulder-joints and adjoining muscles, with an unusual sensation and tingling along the spinal marrow. This soon extends itself from thence to the nerves of the arms and legs, which become weak; and that weakness increases till the extreme parts become paralytic, with a total loss of motion, though a benumbed sensation often remains. Sometimes, by a sudden metastasis, the brain becomes affected, a stupor and delirum come on, and the nervous system is irritated to such a degree as to produce general convulsions, which are frequently followed by death. At other times, the peristaltic motion of the intestines is inverted, and a true iliac passion is produced, which also proves fatal in a short time. Sometimes the paralytic affection of the extremities goes off, and the pain of the bowels returns with its former violence; and on the cessation of the pain in the intestines, the extremities again become paralytic and thus the pain and palsy will alternate for a very long time.

Colica.

Cure. Various methods have been attempted for removing this terrible disease. The obstinate costiveness which attends it, made physicians at first exhibit very strong purgatives and stimulating clysters. But these medicines, by increasing the convulsive spasms of the intestines, were found to be pernicious. Balsam of Peru, by its warm aromatic power, was found to succeed much better; and Dr Sydenham accordingly prescribed it in the quantity of 40 drops twice or thrice a day taken on sugar. This, with gentle purgatives, opiates, and some drops of the hotter essential oils, continued to be the medicine commonly employed in this disease, till a specific was published by Dr Lionel Chalmers of South Carolina. This receipt was purchased by Dr Chalmers from a family where it had long been kept a secret. The only unusual medicine in this receipt, and on which the efficacy of it chiefly if not wholly depends, is vitriolated copper. This must be dissolved in water, in the quantity of one grain to an ounce, and the dose of the solution is a wine-glassful given fasting for nine successive mornings. For the first four or five days this medicine discharges much æruginous bile both ways, but the excretions of this humour lessen by degrees and before the course be ended, it has little other effect than to cause some degree of squeamishness, or promote a few bilious stools, or perhaps may not move the patient at all. At the time of using this medicine the patients should live upon broth made of lean meat, gruel, or panada: but about the seventh or eighth day, they may be allowed bread and boiled chicken. Here the copper seems to do service by its tonic power; and for the same reason, alum, recommended by Dr Percival, most probably cures the disease. He says he has found this very efficacious in obstinate affections of the bowels, and that it generally proves a cure in the slighter cases of the colica pictonum. It was given to the quantity of fifteen grains every fourth, fifth, or sixth hour; and the third dose seldom failed to mitigate the pain, and sometimes entirely removed it. Among purgative medicines, the *oleum Ricini* is found to be the most efficacious.

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304 Sp. III. The Colic from *Costiveness*.

Colica stercorea, *Sauv.* sp. 3.
Ileus a fæcibus induratis, *Sauv.* sp. 2.

For the treatment of this species, see above.

Sp. IV. The *Accidental* Colic.

Colica Japonica,—accidentalis,—lactentium,—a veneno, *Sauv.* sp. 10. 14. 18. 20.
Cholera sicca auriginosa a fungis venenatis, *ejusd.* sp. 2.

When cholics arise from acrid poisonous matter taken into the stomach, the only cure is either to evacuate the poison itself by vomiting, or to swallow some other substance which may decompound it, and thus render it inactive. The most common and dangerous substances of this kind are corrosive mercury and arsenic. The former is easily decompounded by alkaline salts; and therefore a solution of lixivial salt, if swallowed before the poison has time to induce a mortification of the bowels, will prove a certain cure. Much more uncertain, however, is the case when arsenic is swallowed, because there is no certain and speedy solvent of that substance yet known. Milk has been recommended as efficacious; and lately a solution of *hepar sulphuris*. The latter may possibly do service; as arsenic unites readily with sulphur, and has its pernicious qualities more obtunded by that than by any other known substance: but indeed, even the solvent powers of this medicine are so weak, that its effects as well as those of others must be very uncertain.

Some kinds of fungi, when swallowed, are apt to produce colics attended with stupor, delirium, and convulsions; and the same sometimes happens from eating a large quantity of the shell-fish known, by the name of muscles (the Mytulus). Some of the fungi, doubtless, may have an inherent poisonous quality; but generally they as well as the muscles act on a different principle. Their pernicious effects happen most commonly when they are taken on an empty stomach; and are then supposed to be occasioned by their adhering so close to its coats, that it cannot exert its powers, and the whole system is thrown into the utmost disorder. The malady may therefore be very easily prevented; but when once it has taken place, it cannot be removed till either a vomiting be excited, or the stomach has recovered itself in such a manner as to throw off the adhering matter.

305 Sp. V. Colic of *New-born Infants* from a *Retention* of the *Meconium*. (*Sauv.* sp. 19.)

This disorder would be prevented were children allowed immediately to suck their mothers, whose milk at first is purgative. But as this is not commonly done, the child is frequently troubled with colics. These, however, may be removed by a few grains of ipecacuanha, or a drop or two of antimonial wine. By these means the stomach is cleansed by vomiting, and the belly is generally loosened; but if this last effect does not happen, some gentle purge will be necessary.

306 Sp. VI. Colic from a *Callosity* of the *Colon*.

It is in a manner impossible to discover this distemper before the patient's death; and though it should, it does not admit of a cure.

Colica.

Sp. VII. The Colic from *Intestinal Calculi* (*Sauv.* sp. 10. 15.) 307

When certain indigestible bodies, such as cherry stones, plum-stones, small pieces of bones, &c. are swallowed, they frequently prove the basis of calculi, formed by an accretion of some kind of earthy matter; and being detained in some of the flexures of the intestines, often occasion very violent colics. These calculi do not discover themselves by any peculiar symptoms, nor do they admit of any particular method of cure. In the Medical Essays we have an instance of colics for six years, occasioned by calculi of this kind. The concretions were at last passed by stool; and their passage was procured by causing the patient drink a large quantity of warm water, with a view to promote the evacuation of bile, a redundancy of which was supposed to be the cause of her disorder.

Genus LX. CHOLERA, the Cholera Morbus. 308

Cholera, *Sauv.* 253. *Lin.* 186. *Vog.* 110. *Sag.* 188. *Hoffm.* II. 165.
Diarrhœa cholerica, *Junck.* 112.

Sp. I. The *Spontaneous* Cholera, coming on without any manifest cause. 309

Cholera spontanea, *Sauv.* sp. 1. *Sydenh.* sect. iv. cap. 2.
Cholera Indica, *Sauv.* sp. 7.

Sp. II. The *Accidental* Cholera, from acrid matters taken inwardly. 310

Cholera crapulosa, *Sauv.* sp. 11.
Cholera a venenis, *Sauv.* sp. 4. 5.

The cholera shows itself by excessive vomiting and purging of bilious matters, with violent pain, inflation and distension of the belly. Sometimes the patients fall into universal convulsions; and sometimes they are affected with violent spasms in particular parts of the body. There is a great thirst, a small and unequal pulse, cold sweats, fainting, coldness of the extremities, and hiccough; and death frequently ensues in 24 hours.

In this disease, as a larger quantity of bile is deposited in the alimentary canal, particularly in the stomach, the first object is to counteract its influence, and to promote an easy discharge, of it. It is next necessary to restrain that increased secretion of bile, by which a fresh deposition in the alimentary canal would otherwise be soon produced. And, in the last place, measures must often be employed to restore a sound condition to the alimentary canal, which is frequently much weakened by the violence of the disease.

On these grounds, the cure of this distemper is effected by giving the patient a large quantity of warm water, or very weak broth, in order to cleanse the stomach of the irritating matter which occasions the disease, and injecting the same by way of clyster, till the pains begin to abate a little. After this, a large dose of laudanum is to be given in some convenient vehicle,

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vehicle, and repeated as there is occasion. But if the vomiting and purging have continued for a long time before the physician be called, immediate recourse must be had to the laudanum, because the patient will be too much exhausted to bear any further evacuations. Sometimes the propensity to vomit is so strong, that nothing will be retained, and the laudanum itself thrown up as soon as swallowed. To settle the stomach in these cases, Dr Douglas, in the Medical Essays, recommends a decoction of oat-bread toasted as brown as coffee; and the decoction itself ought to be of the colour of weak coffee. He says he does not remember that this decoction was ever vomited by any of his patients. An infusion of mint-leaves or good simple mint-water is also said to be very efficacious in the same case.

The tincture of opium is sometimes retained when given in conjunction with a portion of the vitriolic acid properly diluted. But when it cannot be retained in a fluid form by the aid of any addition, it will sometimes sit upon the stomach when taken in a solid state.

After the violence of the disease is overcome, the alimentary canal, and the stomach in particular, requires to be braced and strengthened. With this view recourse is often had with advantage to different vegetable bitters, particularly to the use of the colombo root; which, while it strengthens the stomach, is also observed to have a remarkable tendency in allaying a disposition to vomiting, which often remains for a considerable time after the cholera may be said to be overcome.

311 GENUS LXI. DIARRHOEA.
LOOSENESS.

Diarrhœa, *Sauv.* gen. 253. *Lin.* 187. *Vog.* 105. *Sag.* gen. 189. *Junck.* 112.
Hepatirrhœa, *Sauv.* gen. 246.
Cholerica, *Lin.* 190.
Cœliaca, *Sauv.* gen. 255. *Lin.* 189. *Vog.* 109. *Sag.* gen. 199.
Lienteria, *Sauv.* gen. 256. *Lin.* 188. *Sag.* gen. 191. *Vog.* 108.
Pituitaria, & leucorrhois, *Vog.* 111. 112.

312 Sp. I. The *Feculent* DIARRHOEA.
Diarrhœa stercorosa & vulgaris, *Sauv.* sp. 1. 2.

THIS is occasioned by the too great quantity of matter thrown into the alimentary canal; and what is discharged has not the appearance of excrements, but is much whiter, and of a thinner consistence. Voracious people who do not sufficiently chew their food, gormandizers, and even those who stammer in their speech, are said to be liable to this disease. In slighter cases it is removed without any medicine, or by a dose of rhubarb; but where the matters have acquired a putrid taint, the disorder may be exceedingly protracted and become dangerous. In this case lenient and antiseptic purgatives are to be made use of, after which the cure is to be completed by astringents.

313 Sp. II. The *Bilious* DIARRHOEA.
(*Sauv.* sp. 8.)

This distemper shows itself by copious stools of a very yellow colour, attended with gripes and heat of the bowels, thirst, bitterness, and dryness of the mouth, yellowness of the tongue, and frequently follows an intermitting or bilious fever. When the fever is gone, the diarrhœa is to be removed by acidulated and cooling drinks, with small doses of nitre.

Diarrhœa.

Sp. III. The *Mucous* DIARRHOEA. 314

Diarrhœa lactentium, *Sauv.* sp. 19.
Dysenteria Parisiaca, *Sauv.* sp. 3.
Diarrhœa ab hypercatharsi, *Sauv.* sp. 16.
Dysenteria a catharticis, *Sauv.* sp. 12.
Pituitaria, *Vog.* 111.
Leucorrhois, *Vog.* 112.
Diarrhœa pituitosa, *Sauv.* sp. 4.
Cœliaca mucosa, *Sauv.* sp. 3.
Diarrhœa serosa, *Sauv.* sp. 10.
a. Diarrhœa urinosa.

This kind of diarrhœa, besides the matters usually excreted, is attended with a copious dejection of the mucus of the intestines with great pain; while the patient daily pines away, but without any fever.—Persons of all ages are liable to it, and it comes on usually in the winter-time; but is so obstinate, that it will sometimes continue for years. In obstinate looseness of this kind, vomits frequently repeated are of the greatest service. It is also very beneficial to keep the body warm, and rub the belly with stimulating ointments; at the same time that astringent clysters, rhubarb, and stomachic medicines, are to be exhibited. Starch clysters are very often efficacious.—Some kinds of looseness are contagious; and Sir John Pringle mentions a soldier who laboured under an obstinate diarrhœa, who infected all those that used the same privy with himself. In the looseness which frequently followed a dysentery, the same author tells us that he began the cure with giving a vomit of ipecacuanha, after which he put the patients on a course of astringents. He used a mixture of three drachms of extract of logwood, dissolved in an ounce and a half of spirit of cinnamon, to which was added seven ounces of common water, and two drachms of tincture of catechu. Of this the patient took two spoonfuls once in four or five hours, and sometimes also an opiate at bed-time. He recommends the same medicine in obstinate diarrhœas of all kinds. A decoction of simaruba bark was also found effectual, when the dysenteric symptoms had gone off. Dr Huck, who used this article in North-America, also recommends it in diarrhœas. Two or three ounces of the simaruba are to be boiled in a pound and a half of water to a pound, and the whole quantity taken throughout the day. He began with the weakest decoction; and, when the stomach of the patient could easily bear it, he then ordered the strongest: but at the same time he acknowledges, that, unless, the sick found themselves sensibly better within three days from the time they began the medicine, they seldom afterwards received any benefit from it. But when all astringents have failed, Sir John Pringle informs us, he hath known a cure effected by a milk and farinaceous diet; and he thinks in all cases the disorder would be much more easily removed, if the patients could be prevailed on to abstain entirely from spirituous liquors and animal-food. If the milk by itself should

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turn sour on the stomach, a third part of lime-water may be added. In one case he found a patient receive more benefit from good butter-milk than from sweet-milk. The chief drinks are decoctions of barley, rice, calcined hartshorn, toast and water, or milk and water.

315 Sp. IV. The Coeliac Passion.

Cœlica chylosa, *Sauv.* sp. 1.
Cœlica lactea, *Sauv.* sp. 4.

There are very great differences among physicians concerning the nature of this disease. Sauvages says, from Aretæus, it is a chronic flux, in which the aliment is discharged half digested. It is attended with great pains of the stomach, resembling the pricking of pins; rumbling and flatus in the intestines; white stools because deprived of bile, while the patient becomes weak and lean. The disease is tedious, periodical, and difficult to be cured. Sauvages adds, that none of the moderns seem to have observed the disease properly; that the excrements indeed are white, on account of a deficiency of the bile, but the belly is bound as in the jaundice. Dr Cullen says there is a dejection of a milky liquid of the nature of chyle; but this is treated by Vogel as a vulgar error. He accuses the moderns of copying from Aretæus, who mentions white fæces as a symptom of the distemper; from whence authors have readily fallen into the notion that they never appeared of any other colour in persons labouring under the cœliac passion. This error quickly produced another, which has been very generally received; namely, that the chyle was thrown out of the lacteals by reason of some obstruction there, and thus passed along with the excrements; of which he says there is not the least proof, and agrees with Aretæus that the whiteness is only occasioned by the want of bile. He endeavours to prove at length, that the cœliac passion can neither be occasioned by an obstruction of the lacteals, nor of the mesenteric glands; though he owns that such as have died of this disease and were dissected, had obstructions in the mesenteric glands; but he denies that all those in whom such obstructions occur, are subject to the cœliac passion. He considers the distemper as arising from a cachexy of the stomachic and intestinal juices; and directs the cure to be attempted by emetics, purgatives, antiseptics and tonics, as in other species of diarrhœa.

316 Sp. V. The Lientery.

Lienteria spontanea, *Sauv.* sp. 2.

The lientery, according to Sauvages, differs from the cœliac passion only in being a slighter species of the disease. The aliment passes very quickly through the intestines, with scarce any alteration. The patients do not complain of pain, but are sometimes affected with an intolerable hunger. The cure is to be attempted by stomachics and tonics, especially the Peruvian bark. This disease is most common at the earlier periods of life; and then rhubarb in small quantities, particularly when combined with magnesia, is often productive of the best effects.

Sp. VI. The *Hepatic Flux.* Diarrhœa

Hepatirrhœa intestinalis, *Sauv.* sp. 2. 317

The hepatic diarrhœa is by Sauvages described as a flux of bloody serous matter like the washings of flesh, which percolates through the coats of the intestines by means of the anastomosing vessels. It is the cœliac passion of Trallianus; and which, according to Sauvages, rarely, if ever, occurs as a primary disease. It has, however, been observed to follow an inflammation of the liver, and then almost always proves fatal.

Genus LXII. DIABETES. 318

A profuse discharge of Urine.

Diabetes, *Sauv.* gen. 263. *Lin.* 197. *Vog.* 115. *Sag.* gen. 199. *Junck.* 99. *Dobson*, Med. Observat. Vol. V. p. 298. *Home*'s Clinical Experiments, sect. xvi.
Diuresis, *Vog.* 114.

Sp. I. The Diabetes with *sweet Urine.* 319

Diabetes Anglicus, *Sauv.* sp. 2. *Mead* on Poisons, Essay I. Ejusdem Monita Med. cap. ix. sect. 2. *Dobson* in Lond. Med. observ. Vol. V. art. 27. *Myers* Diss. inaug. de Diabete, Edinb. 1779.
Diabetes febricosus, *Sauv.* sp. 7. *Sydenh.* Ep. resp. ad R. Brady.

Sp. II. Diabetes with *insipid Urine.* 320

M. Lister Exerc. Medicin. II. de Diabete.
Diabetes legitimus, *Sauv.* sp. 1. *Aretæus* de Morb. diuturn. lib. ii. cap. 2.
Diabetes ex vino, *Sauv.* sp. 5. *Ephem. Germ.* D. I. A. II. Observ. 122.

Description. The diabetes first shows itself by a dryness of the mouth and thirst, white frothy spittle, and the urine in somewhat larger quantity than usual. A heat begins to be perceived in the bowels, which at first is a little pungent, and gradually increases. The thirst continues to augment by degrees, and the patient gradually loses the power of retaining his urine for any length of time. It is remarkable, that though the patients drink much, the quantity of urine always exceeds what is drank. In Dr Home's Clinical Experiments we have an account of two patients labouring under this disease; one of them drank between 10 and 12 English pints a-day without being satisfied. The quantity was greater in the forenoon than in the afternoon. In the other the case was reversed. He drank about four pints a-day, and more in the afternoon than the forenoon. The former passed from 12 to 15 pints of urine in the day: the latter, 11 or 12; so that his urine always exceeded his drink by eight, or at least seven pints. When the urine is retained a little while, there is a swelling of the loins, illia, and testes; in this disease the strength gradually decays; the skin is dry and shrivelled; œdematous swellings arise in various parts of the body, but afterwards subside without relieving the disease in the least; and the patient is frequently carried off by convulsions.

The most singular phenomenon in this disease is, that the urine seems, to be entirely or very much di-

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vested of an animal-nature, and to be largely impregnated with a saccharine salt scarce distinguishable from that obtained from the sugar-cane. This discovery was first made by Dr Dobson of Liverpool, who made some experiments on the urine of a person labouring under a diabetes, who discharged 28 pints of urine every day, taking during the same time from 12 to 14 pounds of solid and liquid food. Some of this urine being set a-side, fell into a spontaneous effervescence, changed first into a vinous liquor, and afterwards into an acetous one, before it became putrid and offensive. Eight ounces of blood taken from the same patient, separated into crassamentum and serum; the latter being sweet to the taste, but less so than the urine. Two quarts of the urine, evaporated to dryness, left a white cake weighing four ounces two drachms and two scruples. This cake was granulated, and broke easily between the fingers: it smelled sweet like brown sugar; neither could it by the taste be distinguished from sugar, except that it left a slight sense of coolness on the tongue. The experiment was repeated after the patient was recovered to such a degree as to pass only 14 pints of urine a-day. There was now a strong urinous smell during the evaporation; and the residuum could not be procured in a solid form, but was blackish, and much resembled very thick treacle. In Dr Home's patients, the serum of the blood had no preternatural sweetness; in one of them the crassamentum was covered with a thick inflammatory crust. In one of these patients the urine yielded an ounce and a half, and in the other an ounce, of saccharine matter from each pound. It had, however, an urinous smell, and a saline taste mixed with the sweet one; and the urine of one fermented with yeast, we are told, into "tolerable small-beer." Both these patients had a voracious appetite, and perpetual gnawing sense of hunger; as had also Dr Dobson's patient. The insipid urine of those affected with diabetes has not been examined by physicians with sufficient accuracy to enable us to speak with confidence of its contents.

Causes. These are exceedingly obscure and uncertain; spasms of the nervous system, debility, and every thing inducing it, but especially strong diuretics and immoderate venery, have been accused as bringing on the diabetes. It has, however, occured in persons where none of all these causes could be suspected; nor have the best physicians been able to determine it.—Dissections have only shown that the kidneys were in an enlarged and lax state. In one of Dr Home's patients who died, they smelled sour; which showed that the urine peculiar to diabetes came from the kidneys, and was not sent directly from the intestines by a retrograde motion of the lymphatics, as some imagine.

Prognosis. The diabetes is rarely cured, unless when taken at the very beginning, which is seldom done; and in a confirmed diabetes the prognosis must therefore be unfavourable.

Cure. As there is reason to believe that in this affection the morbid secretion of urine, which is both preternatural in point of quantity and of quality, arises from a morbid diminution of tone in the kidney, the great object in the cure must be the restoration of due tone to the secreting vessels of the kidney. But as even this diminished tone would not give rise to the peculiar vitiated secretion without a morbid sensibility of that organ, it is necessarily a second object to remove this morbid sensibility. But besides this, the morbid secretion of urine may also be counteracted both by a diminution of the determination of fluids to the kidney, and by preventing the occurrence of superfluous water in the general mass of blood.

Diabetes.

On these grounds the principal hopes of a cure in this distemper are from astringent and strengthening medicines. Dr Dobson's patient was relieved by the following remedies; which, however, were frequently varied, as none of them produced their good effects for any length of time: The bark in substance, with small doses of rhubarb; decoction of the bark, with the acid elixir of vitriol; the cold infusion of the bark, of which he drank from a quart to two quarts daily; Dover's powder; alum-whey; lime-water; antimonials combined with *tinctura Thebaica*. The warm bath was used occasionally when the skin was remarkably hot and dry, and the patient complained of restlessness and anxiety. The tincture of cantharides was likewise tried; but he could never take more than 25 drops for a dose, without exciting great uneasiness in his bowels. The body was kept constantly open, either with rhubarb or the infusion of sena joined with rhubarb. His common drinks were rice-water, barley-water, lime-water, and milk; lime-water alone; sage, balm, or mint-tea; small-beer, simple water, and water acidulated with the vitriolic acid. In seven months, these remedies, in whatever manner varied, made no further progress in removing the disease. In Dr Home's patients, all these medicines, and many others, were tried without the least good effect; insomuch that he uses this remarkable expression: "Thus, these two patients have exhausted all that experience had ever recommended, and almost all that theory could suggest; yet, in both cases, the disease has resisted all the means of cure used." It is remarkable, that though septics were given to both, in such quantity as evidently to produce a putrescency in the *primæ, viæ*, the urine remained unaltered both in quantity and quality.

But although this disease be frequently in its nature so obstinate as to resist every mode of cure, yet there can be no doubt that particular remedies have succeeded in different cases. Dr Brisbane relates several cases cured by the use of tincture of cantharides: and Dr M'Cormick has related some in the 9th volume of the Edinburgh Medical Commentaries, which yielded to Dover's powder after a variety of other remedies had been tried in vain.

Genus LXIII. HYSTERIA. 321

Hysterics.

Hysteria, *Sauv.* gen. 135. *Lin.* 126, *Vog.* 219. *Sag.* gen. 242.
Malum hystericum, *Hoffm.* III. 50. *Junck.* 36.
Affectio hysterica, *Willis* de Morb. Convulsiv. cap. 5. 10. 11. *Sydenham* Diss. Epist. ad G. Cole, *Whytt* on Nervous Disorders.

Description. The hysteria is a convulsive disease, which comes on at uncertain intervals, sometimes longer and sometimes shorter, but at no stated time. The paroxysms commonly begin with a languor and debility

Spasmi lity of the whole body; yawning, stretching, and restlessness. A sense of coldness also in the extremities, almost always precedes, and for the most part remains during the whole time of, the paroxysm. To this sometimes succeeds a sense of heat; and the two sensations alternate with each other in different parts of the body. The face is sometimes flushed and sometimes pale; and sometimes the paleness and flushing come alternately. There is a violent pain in the head; the eyes become dim, and pour out tears; there is a rumbling and inflation of the intestines; a sensation is felt like that of a globe ascending from the lower part of the abdomen or hypogastrium which sometimes seems to roll along the whole alimentary canal. It ascends to the stomach, sometimes suddenly, sometimes slowly; and there produces a sense of inflation and weight, together with anxiety, nausea, and vomiting. At last it comes up to the throat, where it produces a sense of suffocation, and difficulty of breathing or swallowing. During this time there are the most violent pains both in the external and internal parts of the abdomen; the muscles are convulsed; the umbilicus is drawn inwards; and there are frequently such spasms of the intestines, that neither clysters can be injected, nor even flatus pass downwards. Sometimes the paroxysm remits after these symptoms have continued for a certain time, but more frequently the patients fall into fainting fits; sometimes they lie without motion, as if they were in a deep sleep; sometimes they beat their breasts violently and continually with their hands, and sometimes they are seized with general covulsions, and the disease puts on the appearance of an epilepsy. In some patients the extremities become cold and stiff, and the body has the appearance of one in a catalepsy. Sometimes a most violent beating pain takes place in some part of the head, as if a nail was driving into it, and all visible objects seem to turn round; grievous pains attack the loins, back, and bladder, and the patients make a surprising quantity of urine as limpid as water; which last is one of the surest signs of the disease. The mind is very much affected as well as the body. Sometimes the patients are tormented with vain fears; sometimes they will laugh, at other times cry immoderately; and sometimes their temper becomes so peevish and fretful, that they cannot enjoy a moment's quiet. The appearances which take place in this affection are indeed so much varied, that they can hardly be enumerated: they may, however, with propriety, be divided into hysteric fits, which very much resemble those of epilepsy, excepting that they are not attended with an abolition of the internal senses; and hysteric symptoms, such as the *globus hystericus*, *clavus hystericus*, and the like, which are chiefly known to constitute a part of this disease from being observed to alternate with fits.

Causes, &c. The general cause of hysteria is thought by the best physicians to consist in a too great mobility and irritability of the nervous system, and of consequence the disease may be brought on by whatever debilitates and renders the body irritable. Hence it most frequently attacks females of a weak and lax habit of body, though there are some instances of men also attacked by it. It generally comes on between the time of puberty and the age of 35, and makes its attacks during the time of menstruation more frequently than at any other. It also more frequently seizes barren women and young widows, than such as are bearing children. Hysteria.

Prognosis. Though the appearance of this disease be so very terrible, it seldom proves mortal unless by wrong treatment: but notwithstanding this it is extremely difficult of cure, and rarely admits of any thing else than being palliated; for though it should seem to be conquered by medicine for a time, it very quickly returns, and that from the slightest causes.

Cure. The ends principally to be aimed at in the cure of this disease are, in the first place, the removal of particular convulsive or spasmodic affections immediately producing various appearances in the disease, whether under the form of proper hysteric fits, or merely of what may be called hysteric symptoms; and in the second place, the prevention of the return of symptoms after they have been removed, by the employment of proper remedies during those intervals from complaints which patients often have when labouring under this affection.

The most powerful remedy hitherto discovered in hysteric cases is opium, or the tincture of it called *laudanum*. By this commonly the most violent paroxysms are stopped, though it be insufficient to accomplish a radical cure. In Dr Home's Clinical Experiments we find an instance of a cure performed by venesection, though this remedy has been generally condemned in hysterical cases. Asafœtida seems to stand next in virtue to opium; though with some it disagrees, and occasions pains in the stomach and vomiting. Æther will also frequently remove an hysteric fit: but its effects are of short duration; and if it do not effect a cure soon after its exhibition, no service is to be expected either by perseverance in the use of it or by increasing the dose; and with some constitutions it disagrees to such a degree as to occasion convulsions. If the patient be seized with a violent fit, so that she can swallow nothing, which is frequently the case, it will be proper to apply some strong volatile alkali to her nose; or if that be not at hand, the vapour of burning feathers is sometimes very efficacious. In some instances benefit is derived from the sudden applicaton of cold water to the face or hands; but still more frequently the application of water in a tepid state, particularly the warm pediluvium, is found to be of very great service in bringing about a favourable termination of different violent hysteric symptoms. A plaster of galbanum and asafœtida will also prove serviceable: but it must be remembered, that none of these things will prevent the return of the disease; and therefore a radical cure is to be attempted by exercise, the Peruvian bark, chalybeates, mineral waters, and other tonics; but particularly where the state of the patient is such as to be able to bear it, by the use of the cold bath, which, where it does not disagree with the constitution, is often of the greatest service in preventing returns of this affection.

Genus LXIV. HYDROPHOBIA. 322
The *Dread* of Water.

Hydrophobia, *Sauv.* gen. 231 *Lin.* 86. *Vog.* 30. *Sag.* gen. 343. *Boerh.* 1138. *Junck.* 124. *Mead* on poisons. *Default* sur la rage. *Sauv.* diss. sur la rage. *James* on canine madness. *Dalby*, Virtues

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tues of cinnabar and musk against the bite of a mad dog. *Nugent* on the hydrophobia. *Choisel*, Nouvelle methode pour le traitement de la rage. *Journal de Medicine*, passim. *Medical Obs. and Inquiries*, vol. iii. art. 34. vol. v. art. 20. 26. and App. *Med. Transact.* vol. ii. art. 5. 12. and 15. *Heysham*, Diss. inaug. de rab. canin. Edinb. 1777. *Parry*, Diss. inaug. de rab. contagiosi. sive canin. Edinb. 1778. *Andry*, Recherches sur la rage, 1778. *Vaughan*, Cases of hydrophobia, second edit. 1778.

323 Sp. I. *Hydrophobia Rabiosa*, or Hydrophobia consequent on the *Bite* of a *Mad Animal*.
Hydrophobia vulgaris, *Sauv.* sp. 1.

It is the opinion of some, that Dr Cullen has done wrong in employing the term *hydrophobia* as a generic name, under which canine madness is included: and it must be allowed, that the dread of water, while it is not universal, is also a symptom occurring only late in the disease, at least in the greater part of cases. Perhaps his arrangement would have been less exceptionable, if, following Linnæus, he had adopted *rabies* as a generic term, and had distinguished this particular species by the epithet of *canina*, *contagiosa*, or the like. Disputes, however, about names are in general not very important; and it is sufficient to observe, that the affection now to be treated of is canine madness, or that disease which arises from the bite of a mad animal.

Description. This disease commonly does not make its attack till a considerable time after the bite. In some few instances it has commenced in seven or eight days from the accident; but generally the patient continues in health for 20, 30, or 40 days, or even much longer. The bite, if not prevented, will in general be healed long before that time, frequently with the greatest ease; though sometimes it resists all kinds of healing applications, and forms a running ulcer which discharges a quantity of matter for many days. It has been said that the nearer the wounded place is to the salivary glands, the sooner the symptoms of hydrophobia appear. The approach of the disease is known by the cicatrix of the wound becoming high, hard, and elevated, and by a peculiar sense of prickling at the part; pains shoot from it towards the throat: sometimes it is surrounded with livid or red streaks, and seems to be in a state of inflammation; though frequently there is nothing remarkable to be observed about it. The patient becomes melancholy, loves solitude, and has sickness at stomach. Sometimes the peculiar symptom of the disease, *the dread of water*, comes on all at once. We have an instance of one who having taken a vomit of ipecacuanha for the sickness he felt at his stomach, was seized with the hydrophobia in the time he was drinking the warm water. Sometimes the disease begins like a common sore throat; and the soreness daily encreasing, the hydrophobic symptoms show themselves like a convulsive spasm of the muscles of the fauces. In others, the mind seems to be primarily affected, and they have a real *dread* of water or any liquid before they try whether they can swallow it or not. Dr James, in his Treatise on Canine Madness, mentions a boy sent out to fill two bottles with water, who was so terrified by the noise of the liquid running into them, that he fled into the house crying out that he was bewitched. He mentions also the case of a farmer, who, going to draw some ale from a cask, was terrified to such a degree at its running into the vessel, that he ran out in a great haste with the spigot in his hand. But in whatever manner this symptom comes on, it is certain that the most painful sensations accompany every attempt to swallow liquids. Nay, the bare sight of water, of a looking-glass, of any thing clear or pellucid, will give the utmost uneasiness, or even throws the patient into convulsions.

Hydrophobia.

With regard to the affection of the mind itself in this disease, it does not appear that the patients are deprived of reason. Some have, merely by the dint of resolution, conquered the dread of water, though they never could conquer the convulsive motions which the contact of liquids occasioned: while this resolution has been of no avail; for the convulsions and other symptoms increasing, have almost always destroyed the unhappy patients.

In this disease there seems to be an extreme sensibility and irritability of the nervous system. The eyes cannot bear the light, or the sight of any thing white; the least touch or motion offends them, and they want to be kept as quiet and in as dark a place as possible. Some complain of the coldness of the air, frequently when it is really warm. Others complain of violent heat; and have a great desire for cold air, which yet never fails to increase the symptoms. In all there is a great flow of viscid saliva into the mouth; which is exceedingly troublesome to the patients as it has the same effect upon their fauces that other liquids have. This therefore they perpetually blow off with violence, which in a patient of Dr Fothergill's occasioned a noise not unlike the hollow barking of a dog, and which he conjectures might have given rise to the common notion that hydrophobous patients bark like dogs. They have an insatiable thirst; but are unable to get down any drink, except with the utmost difficulty; though sometimes they can swallow bread soaked in liquids, slices of oranges, or other fruits. There is a pain under the *scrobiculus cordis*, as in the tetanus; and the patients mournfully point to that place as the seat of the disease. Dr Vaughan is of opinion that it is this pain, rather than any difficulty in swallowing, which distresses the patient on every attempt to drink. The voice is commonly plaintive and mournful; but Dr Vaughan tells us there is a mixture of fierceness and timidity in the countenance which he cannot describe, but by which he could know a hydrophobous person without asking any questions.

In this distemper, indeed, the symptoms are so various, that they cannot be enumerated; for we will seldom read two cases of hydrophobia which do not differ very remarkably in this respect. Some seem to have at times a furious delirium, and an inclination to spit at or bite the bystanders; while others show no such inclinations, but will even suffer people to wipe the inside of their mouths with the corner of a handkerchief in order to clear away the viscid saliva which is ready to suffocate them. In some male patients there is an involuntary erection of the penis, and emission of the

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the semen; and the urine is forced away by the frequent return of the spasms. In a letter from Dr Wolf of Warsaw to Henry Baker, F. R. S. dated Warsaw Sept. 26th, 1767, we have the following melancholy account of the cases of five persons who died of the hydrophobia: "None of them quite lost their right senses; but they were all talking without intermission, praying, lamenting, despairing, cursing, sighing, spitting a frothy saliva, screeching, sometimes belching, retching, but rarely vomiting. Every member is convulsed by fits, but most violently from the navel up to the breast and œsophagus. The fit comes on every quarter of an hour; the fauces are not red, nor the tongue dry. The pulse is not at all feverish; and when the fit is over nearly like a sound pulse. The face grows pale, then brown, and during the fit almost black; the lips livid; the head is drowsy, and the ears tingling; the urine limpid. At last they grow weary; the fits are less violent, and cease towards the end; the pulse becomes, weak, intermittent, and not very quick; they sweat, and at last the whole body becomes cold. They compose themselves quietly as if to get sleep, and so they expire. The blood drawn a few hours before death appears good in every respect. A general observation was, that the lint and dressings of the wounds, even when dry, were always black, and that when the pus was very good in colour and appearance." In one of Dr Wolf's patients who recovered, the blood stunk intolerably as it was drawn from a vein; and one of Mr Vaughan's patients complained of an intolerable fetid smell proceeding from the wounded part, though nobody but himself could perceive it. In general, the violent convulsions cease a short time before death; and even the hydrophobia goes off, so that the patients can drink freely. But this does not always happen; for Mr Vaughan mentions the case of a patient, in whom, "when he had in appearance ceased to breathe, the spasmus cynicus was observable, with an odd convulsive motion in the muscles of the face; and the strange contrariety which took place in the action of these produced the most horrid assemblage of features that can well be conceived. Of this patient also it was remarkable, that in the last hours of his life he ceased to call for drink, which had been his constant request; but was perpetually asking for something to eat."

The hydrophobia seems to be a symptom peculiar to the human race; for the mad animals which communicate the infection, do not seem to have any dread of water. Dr Wolf, in the letter above quoted, says in general, that cattle bit at the same time and by the same animal (a mad wolf) which bit the persons whose cases he related, died nearly with the same frightful raging as the men; but says nothing of their having any hydrophobia: nay, Dr James and some others assert, that the hydrophobia is not always an attendant on rabies canina in the human race; and indeed it is certain that the disease has proved mortal after this terrible symptom has been removed. With regard to the symptoms of madness in dogs, they are very equivocal; and those particularly enumerated by some authors, are only such as might be expected in dogs much heated or agitated by being violently pursued and struck. One symptom indeed, if it could be depended upon, would determine the matter; namely, that all other dogs avoid and run away from one that is mad; and even large dogs will not attack one of the smallest size who is infected with this disease. Upon this supposition they point out a method of discovering whether a dog who hath been killed was really mad or not; namely, by rubbing a piece of meat along the inside of his mouth, and then offering it to a sound dog. If the latter eats it, it is a sign the dog was not mad; but if the other rejects it with a kind of howling noise, it is certain that he was. Dr James tell us, that among dogs the disease is infectious by staying in the same place; and that after a kennel has been once infected, the dogs put into it will be for a considerable time afterwards in danger of going mad also. A remedy for this, he says, is, to keep geese for some time in the kennel. He rejects as false the opinion that dogs when going mad will not bark; though he owns that there is a very considerable change in their bark, which becomes hoarse and hollow.

Hydrophobia.

Causes, &c. In no disease whatever are we more at a loss to discover the causes than in the hydrophobia. In dogs, foxes, and wolves, it seems to come on spontaneously; though this is contested by some authors. It is said, that the causes commonly assigned, viz. heat, feeding upon putrid flesh, want of water, &c. are not sufficient for producing the distemper. It does not appear that madness is more frequent among dogs in the warm than in the cold climates; nay, in the island of Antigua, where the climate is very hot, and the water very scarce, this distemper has never, it is said, been observed. As to putrid aliment, it seems natural for dogs to prefer this to any other, and they have been known to subsist upon it for a long time without any detriment. For these reasons, they think the disease arises from a specific contagion, like the small-pox and measles among the human race, which, being once produced by causes unknown, continues to be propagated by the intercourse which dogs have with each other, as the diseases just mentioned continue to be propagated among the human race by means of the intercourse which they have with one another.

With regard to the immediate cause among mankind, there is not the least doubt that the hydrophobia is occasioned by the saliva of the mad animal being mixed with the blood. It does not appear that this can operate through the cuticula; but, when that is rubbed off, the smallest quantity is sufficient to communicate the disease, and a slight scratch with the teeth of a mad animal has been found as pernicious as a large wound. It is certain also, that the infection has been communicated by the bites of dogs, cats, wolves, foxes, weasels, swine, and even cocks and hens, when in a state of madness. But it does not appear that the distemper is communicable from one hydrophobous person to another, by means of the bite, or any other way. Dr Vaughan inoculated a dog with the saliva of a hydrophobous child, but the animal continued free from disease for two months; and though the doctor promised to inform the public if it should happen to occur afterwards, nothing has hitherto appeared on that subject. A nurse also frequently kissed the child during this time of his disorder, but no bad consequences ensued.

When we attempt to investigate the nature of the

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cause of the hydrophobia by dissections, our inquiries are commonly disappointed. In two bodies opened by Dr Vaughan, there was not the least morbid appearance; in the very fauces, where we might have expected that the disease would have shown itself most evidently, there was not the least appearance even of inflammation. The stomach, intestines, diaphragm, œsophagus, &c. were all in a natural state: neither do we find in authors of credit any certain accounts of morbid appearances in the bodies of hydrophobous persons after death. Dr Vaughan therefore concludes, that the poison acts upon the nervous system; and is so wholly confined to it, that it may be doubted whether the qualities of the blood are altered by it or not; and that it acts upon the nerves by impairing and disturbing their functions to such a degree as speedily to end in a total extinction of the vital principle. As to the difficulty in swallowing generally believed to accompany dread of the water, he treats it as a misrepresentation, as well as that the œsophagus with the muscles subservient to deglutition are especially concerned in this disease. The principal foundation of the evil, he thinks, rests on a morbid sensibility both of the external and internal fauces. For the sight of a liquid, or the application of any substance to the internal fauces, but more especially of a fluid, instantly excites the most painful feelings. Nay, the same symptoms are produced by touching the external fauces with a fluid, or by the contact of cold air with these parts; and nearly in as great a degree. But a solid or a fluid substance being conveyed into the œsophagus, the transit into the stomach is accomplished with little or no impediment; so that in fact the difficulty is surmounted before the patient be engaged in the action of swallowing. Nor is the excruciating pain, which never fails to be the companion of every attempt to drink, felt in the *fauces* and *throat*: it is, he says, at the *scrobiculus cordis*; to which the sufferer applies his hand. From this last circumstance, therefore, from the presence of the *risus sardonius*, from the muscles of the abdomen being forcibly contracted, and from the sense of suffocation which seems to threaten the patient with immediate death, Dr Vaughan has been led to think that in the hydrophobia a new sympathy was established between the fauces, the diaphragm, and the abdominal muscles.

Prognosis. When a person is bit, the prognosis with regard to the ensuing hydrophobia is very uncertain. All those who are bit do not fall into the disease; nay, Dr Vaughan relates that out of 30 bit by a mad dog, only one was seized with the hydrophobia. During the interval betwixt the bite and the time the disease comes on, there are no symptoms by which we can judge whether it will appear or not. When once it hath made its appearance, the prognosis is exceedingly fatal.

Prevention and Cure. It has been generally allowed by practitioners, that though the hydrophobia may be prevented, yet it can seldom if ever be cured after it has made its appearance. The most essential part of the treatment therefore depends on the proper use of means of prevention. The great objects to be aimed at in prevention, are, in the first place, the complete removal of the contagious matter as soon as possible; or, secondly, means of destroying it at the part, where there is even the slightest reason to believe that it has not been completely removed. Of all the means of removal, the complete cutting out the part to which the tooth has been applied, is unquestionably the most to be depended upon. This practice, therefore, should be had recourse to as soon as possible. The sooner it can be accomplished, the better. But as it has been observed, that a peculiar sensation at the part affected always precedes the accession of the disease, even when it takes place at a late period after the bite, there is good ground for believing that removal of the part may be of advantage even after a considerable interval. But besides removal of the contagious matter, by cutting away the part to which it is attached, this should also be done by careful and long continued washing. This may be done, in most instances, before a proper opportunity can be had of having recourse to the knife. Cold water should particularly be poured upon the wound from a considerable height, that the matter may be washed away with some force. Even after removal by the knife, careful washing is still a necessary and proper precaution And after both these, to prevent as far as can be, the possibility of any contagious matter lurking about the wounded part, it should not be allowed to heal, but a discharge of matter should be supported for the space of several weeks, by ointment with cantharides, or similar applications. By these means there is at least the best chance of removing the matter at a sufficiently early period. And this mode of prevention seems to be of more consequence than all others put together which have hitherto been discovered. But besides removal, prevention may also be obtained by the destruction of the contagious matter at the part; and where there is the least reason to think that a complete removal has not been obtained, these should always be had recourse to. With this intention the actual cautery and burning with gun-powder have been employed. And the action of fire is probably one of the most powerful agents that can be used for this purpose. But recourse has also been had to washing both with acids and with alkalies. Of the former kind, vinegar has been chiefly used, but more may probably be expected from the latter; and particularly from the caustic alkali, so far diluted that it can be applied with safety: for from its influence as a solvent of animal mucus, it gives a better chance of a complete removal of the matter, independent of any influence in changing its nature. It has been thought also, that oil applied to the part may be of service. But if recourse be had to it, more active measures should at least be previously employed; and even then, some are of opinion that it is of advantage to increase the activity of the unctuous matter by combining it with mercury.

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On these grounds, and by these means, we are inclined to think that the action of this contagion on the system, after it has been applied by the bite of a rabid animal, may be most effectually prevented. But after this action has once taken place, no remedy has yet been discovered on which much dependence can be put. A very great variety of articles indeed have at different periods been held forth as infallible, both in the prevention and cure of this affection; but their reputation has, perhaps, universally been founded on their being given to people, who, though really bit

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bit by a mad dog, were yet not infected with the contagion. And this happily, either from the tooth being cleaned in making the bite, or not being covered with contagious matter, is by no means an unfrequent occurrence. Mankind, however, even from the earliest ages, have never been without some boasted specific, which has been held forth as an infallible remedy for this affection till fatal experience demonstrated the contrary. Dr Boerhaave has given a pretty full catalogue of those specifics from the days of Galen to his own time; and concludes, that no dependence is to be put in any of them. It is now, therefore, altogether unnecessary to take notice of burnt crabs, the hyæna's skin, mithridate with tin, liver of the rabid animal, or a variety of other pretended remedies for this disease, proved by experience to be totally inefficacious. But although no greater confidence is perhaps to be put on specifics of modern date, it will be proper that these should be mentioned.

Bathing in cold water, especially in the sea, and drinking sea-water for a certain time, have been prescribed, and by some accounted a certain preventive. When this was known to fail, a long course of antiphlogistic regimen, violent submersion in water, even to danger of drowning, and keeping the wounded place open with cauteries, were recommended.—To this extreme severity Dr Mead objected; and in his treatise on this subject endeavours to show, that in all ages the greatest success has been reaped from diuretics, for which reason he proposes the following powder: "Take ash-coloured ground-liverwort, half an ounce; black-pepper, two drachms: reduce them separately to powder, then mix them together." This powder was first published in the Philosophical Transactions, by Mr Dampier, in whose family it had been kept as a secret for many years. But this medicine, which was inserted in former editions of the London and Edinburgh pharmacopœias, under the name of *Pulvis Antilyssus*, has long lost its credit.

There is a famous East-India medicine, composed of 24 grains of native and as much factitious cinnabar, made into a powder with 16 grains of musk. This is called the *Tonquin* medicine, and must be taken in a tea-cupful of arrac or brandy; and is said to secure the patient for 30 days, at the expiration of which it is to be repeated; but if he has any symptoms of the disease, it must be repeated in three hours, which is said to be sufficient for a cure. The first dose is to be taken as soon after the bite as possible.

Another celebrated remedy is Palmarius's powder, composed of the leaves of rue, vervain, sage, polypody, wormwood, mint, mugwort, balm, betony, St John's-wort, and lesser centaury. These herbs must be gathered in their prime, dried separately in the shade, and then powdered. The dose is a drachm, or a drachm and an half, taken every day.

A remedy which might promise to be more efficacious than any of those hitherto mentioned is mercury. This hath been recommended in frictions, and to be taken inwardly in the form of calomel and turbith-mineral, in order if possible to raise a slight salivation, on which the efficacy was thought to depend. Besides this, venesection, opium, the bark, and camphor, have been tried in very large quantities; the warm bath; and, in short, every thing which human invention could suggest; but with what success, can best be judged from the following well authenticated cases.

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In the beginning of December 1728, a young gentleman, aged 17, was bit by a dog in the middle-finger of the right-hand about the middle of the nail. In the beginning of January 1729, he complained of pain in that finger reaching along the back of the hand to the elbow. In the night between the sixth and seventh days of that month he became hot and restless: emollient and anodyne fomentations were applied; but the pain became very sharp, and the hydrophobia came on in the night-time. He was blooded; but became worse every hour, and at last quite furious and outrageous. The bandage was thrown off from his arm, and he lost about 20 ounces of blood besides what had formerly been taken from him. This, however, made no abatement of the symptoms, and he died the same night.

In 1753, a woman, seized with the hydrophobia in consequence of the bite of a dog supposed to be mad, was treated in the following manner by Dr Nugent. First she was blooded to about 15 ounces; she took 15 grains of musk in powder, and alongst with it a pill of two grains of pure opium, every three hours. A plaster of galbanum, with half an ounce of pure opium, was laid to her neck and throat. She began to take these medicines on a Saturday morning, an hour or two after the dread of water had commenced. In the evening she was a little easier at intervals. The musk and opium pill were continued as before, and the hand that was bit was ordered to be chafed with warm salad oil several times a day. Only two papers of powder and two pills were taken in the night, for the last made her sick and vomit. She had little or no sleep, but lay pretty quiet.—On Sunday, 20 ounces of blood were taken away, and a clyster with antimonial wine injected: the pills and powders were continued as before. On Sunday evening she could swallow liquids a little better, and she lay quiet most of the night. On Monday her swallowing was greatly better. The musk and opium were continued, and twelve ounces more of blood were taken from her; the plaster was renewed with only two drachms of opium, and the oil was used as before. At night she was better; her hand easy; and by a continuance of these remedies she recovered.—This was the case which chiefly brought opium into reputation.

The following cases published by M. Dessault, a Frenchman, first brought mercury into reputation.—Four men were bitten by the same wolf, on the same day, at the same hour. They were dipped in salt-water, and came back persuaded that they had nothing to fear. Some days after, one of them felt a numbed pain about his scars, while the scars themselves grew hard and rose like an embroidery: he was soon after seized with the usual symptoms, as was also another. The son of the former likewise began to feel a pain about the cicatrices, and a swelling with hardness; as did also the fourth. They were ordered to rub a drachm and a half of the mercurial or blue ointment upon the cicatrices and about the whole arm. This was repeated three days successively, and then every other day: after the fifth friction, he allowed an interval of two days. Besides this, they took every day a drachm and an half of Palmarius's powder. After the third friction the cicatices grew flat and soft, the pain

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went off, their courage returned, and their mind resumed its former tranquillity.

But how far mercury, or indeed any thing else, is from being a *specific* in the hydrophobia, will appear from the following account of Dr Wolf's patients.—In the middle of April 1767, seventeen people, and a great number of cattle were bitten in the neighbourhood of Warsaw by a mad wolf. One of these, an officer, was brought into the city that same day, and had the best advice of the surgeons and physicians in that place; besides which, he took the bark very copiously with camphor. He continued well till the seventh week, when he became hydrophobous, and died.

Eleven of the others applied to Dr Wolf on the ninth day. Their wounds were all deeply scarified; diligently washed and fomented with vinegar, salt, and theriaca; and kept open till the 80th day, in those who lived so long. Every two weeks they were blooded largely, and were purged every week with salts and jalap. Their diet was mostly vegetable, and their drink whey and water. They all eat as much as could be got of the herbs *matrisylva* and *anagallis flore puniceo;* and they all took often the *pulvis Palmarii.* The *muscus cinereus terrestris* could not be got, or it would also have been prescribed. Besides the general treatment, two were rubbed daily with a drachm of mercurial ointment, and had their purges with calomel. Two took every day four ounces of vinegar, three drachms tincture of poppies, and half an ounce of *rob sambuci* every night. One took every day 16 grains of camphor, with four scruples of saltpetre, and at night half an ounce of *rob sambuci.*—Two took 24 grains of musk, with 50 grains of cinnabar. Other two took from 40 to 60 drops of spirit of sal ammoniac, prepared with quick-lime; and the last took a scruple of crystallized salt of tartar made by the mixture of a little spirit of sal ammoniac with a solution of that salt.

One of the first who used the mercurial ointment was seized with the hydrophobia on the 22d day, immediately after being well purged with calomel. He was blooded copiously, plunged abundantly in cold water, and had several clysters administered, without effect. Two pounds of oil, and as much of drink, were poured down by force; also a drachm of salt of tartar and half a drachm of musk were given in three doses. He then began to drink freely, but died the third day. His companion then left off the use of mercury, and took 80 drops a-day of Dippel's animal oil, till he had taken six drachms of it; after which he went on with 100 drops daily of spirit of sal ammoniac made with alkali.

One of those who took the vinegar fell sick the 33d day. He was immediately blooded, and vomited with ipecacuanha. This man was too strong to make experiments on by force: he refused every thing, and died the third day. His companion, on old man, began to be seized in the same manner: he was purged with salts, took the *morsulæ balsami Peruviani,* and drank lemonade. He recovered, and used afterwards 100 drops of spirit of sal ammoniac daily. This was the patient formerly mentioned, whose blood had the fetid smell.

The man who used the camphor fell sick the 33d day. He was thrice copiously blooded, was plunged forcibly into the coldest water for the space of two hours, and was nearly drowned. He was clystered with effect. He himself forced down with incredible aversion and labour, a great quantity of drink; by which he vomited more than 50 times abundance of frothy slime. He took several ounces of oil, and several boluses of castor and opium, of each four grains, without effect; and died the fourth day.

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A girl who used the musk with cinnabar, fell ill the 62d day, and died the third day after. No farther attempt was made to save her life, she being then at a distance. Her companion, a pregnant woman, then left off the musk, and took in its stead spirit of sal ammoniac.

A woman who had taken nothing fell ill on the 40th day. She suffered terribly in the night, but less in the day time. Besides the usual symptoms, she had great pain and swelling in her belly. In the space of two days she drank about two bottles of brandy, but would taste no other liquor. The Doctor ordered her to mix an equal quantity of oil with her brandy, and to take every day two boluses of castor and opium.—She recovered: and at last took two doses of turbith-mineral, by which she was vomited and purged.

After the 80th day, all the surviving people took thrice the turbith-mineral, except the pregnant woman; and they afterwards continued their alkaline medicines to the 100th day.

On these cases Dr Wolf makes the following observations.—"Thus we see, that the bark, the mercury, the acids, the musk, the feeding on the most famous herbs, the sweating, the *cura antiphlogistica,* are no specifics. I don't know what to say to the alkalies: the danger is not yet over; and there are still four people who used nothing, in as good health as my patients."

The following case by Dr Raymond of Marseilles, shows the inefficacy of mercury even as a *preventive.*—On the 19th of July 1765, Mr Boyer, aged 25, of a bloated cachectic habit, was bit by a mad dog in the inferior part of the leg: the wound extended half way round, bled freely, and was like a great scratch. The patient's legs had been swelled for a considerable time before the accident; and there were also two ulcers in the other leg. Some hours after the accident, the actual cautery was applied to the wound. The Doctor was not present at this operation; but the part around the bite was rubbed with mercurial ointment immediately after, and the eschar was dressed with the same ointment. The eschar was separated on the first day, but the dressing was continued till the wound was cicatrised. The second day a bolus of four grains of turbith and eight grains of camphor was exhibited. This procured a considerable evacuation both by vomit and stool, and a spitting also came on. The third day the bitten leg was rubbed with mercurial ointment: in the space of a month the frictions were repeated five times on both legs, three drachms of mercurial ointment being used in each friction. During the same time the bolus was five times repeated; and this treatment kept up a slight salivation to the 40th day. The evening of the third day he took the *Tonquin medicine,* called also *Sir George Cobb's powder,* in a bolus; which vomited him briskly. This powder was repeated seven or eight times in the month, generally with the same effect. During the first seven or eight days he got four times,

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times, in the morning, a drachm of the *anagallis flore puniceo*, fresh gathered and powdered. The 41st day, the turbith bolus was prescribed for the seventh time; he was bathed in the sea, and continued the bathing for two days more. On the 74th he was seized with the distemper; and died on the 76th seemingly suffocated or strangled, his mouth covered with slaver, and his face bloated. He lost his senses not above half a quarter of an hour before his death. The pulse was quiet the whole time. The Doctor says he has reason to suspect the wound was not well cauterized.

Another instance is mentioned by the same author, of a pregnant woman bit by the same dog and on the same day with Mr Boyer, who was never seized with the distemper. She was treated in much the same manner with him, and salivated a little more. But she was bit through a shamoy leather shoe, which must necessarily have cleaned the animal's teeth of the poisonous saliva before they reached her skin, and to this we are naturally led to ascribe her safety. One of Dr Wolf's patients also was a pregnant woman, and was not seized with the distemper. Perhaps women in a state of pregnancy may be less liable to this distemper than others; but it is more probable that the contagion was not communicated.

The same author tells us, "there are many examples of the inefficacy of mercurial frictions. A surgeon of Marseilles treated a girl about 12 years of age bit by a mad dog, with mercurial frictions; applying them as in the *lues venerea*: yet she died of the hydrophobia on the 55th day. Her wound was not cauterized."

In the following case all the most powerful remedies were tried.—In the afternoon of the 29th of Aug. 1778, Dr Vaughan was called to a boy of eight years of age labouring under a hydrophobia. He had been bit on the wrist by a cat about a month before; of which the marks remained, but without any ulcer, or even the smallest appearance of inflammation. About the middle of the day before Dr Vaughan saw him, he began to complain of a pain in the part bitten, which ascended up the arm, and affected the temple on that side; soon after which he swallowed liquids with reluctance and difficulty. He was put into the warm bath for three quarters of an hour, during which time he was easier: he had a clyster of five ounces of fresh broth, and 30 drops of laudanum, injected immediately after his coming out of it; a liniment consisting of three drachms of strong mercurial ointment, with the same quantity of oil of amber, was rubbed upon the shoulders and back; two pills of a grain of flowers of zinc, and half a grain of *cuprum ammoniacum*, were taken every three or four hours; and a medicated atmosphere was prepared for him, by burning gum ammoniac in his room. As these remedies were not attended with any good effect, each dose of pills was ordered to contain two grains of *cuprum ammoniacum*, the same quantity of opium, three grains of flowers of zinc, and ten grains of asafœtida; whilst a solution of that fetid gum, with a drachm of laudanum was administered as a clyster. These pills, though repeated every four hours, afforded not the smallest relief, nor did they show the least action on the frame. At last the Doctor resolved to put in practice the desperate remedy mentioned by Van Helmont, of throwing the patient into cold water and keeping him there till he is almost drowned. With this view a large tub of cold water, well saturated with common salt, was prepared, into which the poor boy was plunged over head and ears, and there held until he ceased to struggle. He was then taken out again, and the same operation repeated until he became so quiet that the Doctor was under apprehensions that a total extinction of life would take place. He was then wrapped up in a blanket and put to bed, and he remained more quiet than he had formerly been; but all his former restlessness soon returned, his pulse sunk, and he died about two'clock in the morning.

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Another celebrated antidote against the poison of a mad dog hath been known for some years by the name of the *Ormskirk medicine*. The true composition of this is kept a secret by the proprietors: however, it has been analysed, and the following composition published by Dr Heysham as perfectly similar to it in all respects.

"Take half an ounce of chalk, three drachms of Armenian bole, ten grains of alum, one drachm of elecampane in powder; mix them altogether, and add six drops of oil of anise."

They must certainly be very credulous who can put confidence in such an insignificant medicine as a preservative against the hydrophobia: however, there is a possibility that there may be some unknown ingredient in the genuine powder; for it is difficult to analyse powders after the ingredients are thoroughly mixed together. The efficacy of the medicine therefore must depend on the virtues of that unknown ingredient, if any such there be. The following cases, however, too well determine that it is not *infallible*, as was at first pretended. In all probability, as well as many others, its reputation also is solely rested on its being exhibited in many cases where no contagion was communicated to the person bit, and while of course no disease could take place.

On the 14th of February 1774, Mr Bellamy of Holborn, aged 40, was bit by a cat, which was killed the same morning. The following day he took the celebrated Ormskirk medicine, sold by Hill and Berry in Hill-Sreet, Berkeley-Square, and conformed in every respect to the directions given by the vender. A servant-maid who was bitten in the leg before her master was bitten, likewise took the same remedy. About the middle of April Mr Bellamy complained of a pain in his right knee, which he supposed to be rheumatic, and which continued and increased till the 7th of June, when he got some pills of calomel, ipecacuanha, and *pil. sapon.* from an apothecary, which huxham's tincture of the bark in small doses. In six days more he had a titillation in the urethra, a contraction of the scrotum and penis to a degree of pain, and an emission of semen after making water, to which he had frequent calls. The medicines were discontinued; and on the 16th of that month the hydrophobia came on, and Dr Fothergill was called. Six ounces of blood were taken from his arm, and a bolus of a scruple of native cinnabar and half a scruple of musk was given every four hours. The distemper manifestly increased through the day. In the evening a clyster was injected, and several times repeated during the night; he had been put into the warm bath, and two drachms of strong mercurial ointment rubbed into his legs and thighs by

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himself. He was greatly relieved by the warm bath while he continued in it, but the symptoms returned with increased violence in the night. The next day, being greatly worse, he was blooded to as great a quantity as he could bear, had the warm bath and clysters repeated, and half an ounce of mercurial ointment rubbed into his thighs and legs. Pills of opium were prescribed, but he did not take them. He died the same night, at half an hour after 12. This patient was a man of great resolution, and could in part conquer his aversion at water. He seemed to have totally forgot the accident of the bite: and casually said, that he thought this disorder resembled the hydrophobia, without supposing that he was afflicted with that distemper at the time.—The bite on the girl's leg refused to heal, baffled the art of a young surgeon who attempted to cure it, and continued a running ulcer for a long time. She did not fall into the hyprophobia. Hence Dr Fothergill thinks it probable, that keeping the wounds made by the teeth of mad animals open for a long time, would probably be of service as a preventive; but in some of Dr Wolf's patients, these artificial drains appear not to have been attended with success.

On the 16th of November 1773, Thomas Nourse, a strong healthy boy of 14, was admitted into the Leicester infirmary; having been that day month bitten by a mad fox-hound. The wound was a large lacerated one on the cheek, and bled very freely on being inflicted. The day after he was bit he went to the sea, where he was dipped with all the severity usually practised under so disagreeable an operation. The *Ormskirk medicine* was also administered with all due care. It was bought of the person in Leicester who is deputed by the proprietor to sell it for him. A common adhesive plaster was applied to the part after sea-bathing; and in the course of a month, without any further trouble, the wound was healed; excepting a small portion, somewhat more than an inch in length, and in breadth about one-tenth. This yielded no discharge, and was quite in a cicatrizing state. Five days before his admission into the infirmary, he began to complain of a tightness over his temples, and a pain in his head: in two days the hydrophobia began to appear; and at its commencement he complained of a *boiling heat* in his stomach, which was continually ascending to the fauces. The disease was pretty strong when he came to the infirmary. He got a bolus of a scruple of musk with two grains of opium; then a composition of 15 grains of musk, one of turbith mineral, and five grains of opium, was directed to be taken every third hour; an ounce of the stronger mercurial ointment was to be rubbed on the cervical vertebræ and shoulders, and an embrocation of two ounces of laudanum, and half an ounce of *acetum saturninum*, was directed to be applied to the throat. But by this last he was thrown into convulsions, and the same effect followed though his eyes were first covered with a napkin. The embrocation was therefore changed for a plaster of three drachms of powdered camphor, half an ounce of opium, and six drachms *confectio Damocritis*. By these medicines the disease seemed to be somewhat suspended, but the symptoms returned with violence in the evening. His medicine was repeated at seven; and at eight five grains of opium were exhibited without musk or turbith. At nine, another ounce of mercurial ointment was rubbed upon the shoulders, and half an ounce of laudanum with six ounces of mutton-broth was injected into the intestines, but to no purpose. A larger dose of opium was then given, but with as little effect as the former, and he died the same night.

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In the month of September 1774, a farmer, aged 25, was bit by a mad dog, whose teeth made a slight wound in the fore-finger of the left hand. He was dipped, as usual, in the sea; and drank the sea-water for some time on the spot, which operated briskly as a purge. He continued well till the 6th of June following, when he first felt a pain in that hand and arm; for which he bathed in a river that evening, supposing that it had been a rheumatic complaint. The next day he was sick; and in the evening was seized with a violent vomiting, which continued all that night and till the middle of the next day, when it was succeeded by the hydrophobia. He was treated with the warm bath; had a purgative clyster injected; and as soon as it had operated, a second was given, consisting of four ounces of oil, and half an ounce of laudanum: half an ounce of strong mercurial ointment was rubbed on the fauces, and the part was afterwards covered with the *cataplasma e cymino*, to which was added an ounce of opium. An embrocation was applied to the region of the stomach with continued friction, consisting of half an ounce of spirit of sal ammoniac, ten drachms oil olive, six drachms of oil of amber, and ten drachms of laudanum. Two ounces of strong mercurial ointment were rubbed upon the shoulders and back; and as a further means of kindling a ptyalism speedily, he received the smoke of cinnabar into the mouth by throwing a drachm of that substance now and then upon a hot iron: he was also directed to take every four hours a bolus of 15 grains of musk, three grains of turbith mineral, and four grains of opium. He was easier while in the warm bath, and during the application of the ointment; but died the same night about two o'clock.

Many other instances might be adduced of the inefficacy of this pretended specific: the danger of acquiescing in which, will, it is hoped, create a due degree of caution in those to whom they who are so unfortunate as to be bit by a mad animal may commit themselves. Another remedy may also be mentioned as having had the reputation of being sometimes successful in this disease; which is chiefly employed in different parts of India, particularly in the territory of Tanjore. The medicine to which we now allude contains indeed several articles which are altogether unknown in our materia medica: but it contains at least one very powerful substance well known to us, viz. arsenic. This medicine, known by the name of the Snake Pills, as being principally employed against the bite of the most venomous snakes, is directed to be prepared in the following manner:

Take white arsenic, of the roots of nelli navi, of nevi visham, of the kernels of the ner valum, of pepper, of quicksilver, each an equal quantity. The quicksilver is to be rubbed with the juice of the wild cotton [till] the globules are perfectly extinguished.

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The arsenic being first levigated, the other ingredients, reduced to a powder, are then to be added, and the whole beat together with the juice of the wild cotton to a consistence fit to be divided into pills.

Though these pills are principally used against the bite of the cobra de capello, yet they are said also to be successful in the cure of other venomous bites; and, for the prevention of rabies canina, one is taken every morning for some length of time. Of this remedy European practitioners have, we believe, as yet no experience; and if, in the accounts transmitted by East India practitioners, it cannot be said that we have authentic evidence of its want of success, it can as little be pretended that there is indubitable evidence of its efficacy in any instance; and it is by no means improbable, that it will be found equally inefficacious with others at one time considered as infallible.

Of the great variety of remedies which have had their day of reputation, there is not one which has not possessed the credit, some time or other, of preventing the noxious effects arising from the bite of a mad dog. A more adequate experience has with all of them discovered the deception. It was above observed, that the hydrophobia is by no means the infallible consequence of being bit by a mad animal; and that of between 20 and 30 persons who were bit by the dog which gave the fatal wound to one of Dr Vaughan's patients, not one felt the least ill effect but himself. "In the above number (says the Doctor) were some who took the Ormskirk Medicine; others went to the salt-water; and a part of them used no remedy, who yet fared equally well with the most attentive to their injury. The same thing has often happened before; and much merit, I doubt not, has been attributed to the medicine taken, from that celebrated one of *Sir George Cobb* down to the *infallible* one which my good *Lady Bountiful*'s receipt book furnishes."

From all that has been said, the reader will judge how far the hydrophobia is capable of being subdued by any of the medicinal powers which have yet been tried. Some eminent physicians assert that it is totally incurable; and allege that the instances recorded by different authors of its cure have not been the genuine kind, but that which comes on spontaneously, and which is by no means so dangerous. Indeed two of Dr Wolf's patients recovered, where the disease seems to have been perfectly genuine: but in these the poison seemed to vent itself partly on some other place besides the nervous system. In one the blood was evidently infected, as it had an abominable fœtor; and the other had a violent pain and swelling in the belly. In all the others, it seemed to have attacked only the nervous system; which perhaps has not the same ability to throw off any offending matter as the vascular system.

There is, however, a possibility that the prodigious affections of the nerves may arise only from a vitiated state of the gastric juices; for it is well known, that the most terrible convulsions, nay the hydrophobia, itself, will arise from an affection of the stomach, without any bite of a mad animal. This seems to be somewhat confirmed from one of Dr Wolf's patients, who, though he vomited more than 50 times, yet still threw up a frothy matter, which therefore was evidently secreted into the stomach, just as a continual vomiting, of bilious matter shows a continual and extraordinary secretion of bile. Dr Wolf himself adopts this hypothesis so far as to say, that perhaps the *serum* may become frothy; but in blood drawn from a vein not the least fault appears either in the serum or crassamentum. He affirms, however, that the duodenum appears to be one of the parts first and principally affected; and as it is not inflamed, it would seem that the affection it sustains must arise from the vitiated state of its juices.

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Be this as it will, however, in the hydrophobia, the stomach seems totally, or in a great measure, to lose the power which at other times it possesses. Two grains of *cuprum ammoniacum* were repeatedly given to a child of eight years of age without effect; but this dose would occasion violent vomiting in a strong healthy man. Something or other therefore must have prevented this substance from acting on the nervous coat of the stomach; and this we can only suppose to have been the exceedingly disordered state of the gastric juice, which occasioned such violent irritation through the whole body that the weaker stimulus of the medicine was entirely lost. It would seem proper therefore to consider the stomach in hydrophobic cases as really containing a poisonous matter, which could not be expelled by vomiting, because it is renewed as fast as evacuated. The indication therefore must be, to change its nature by such medicines as are certainly more powerful than the poison; and this indication will naturally lead us to think of large doses of alkaline salts. These, it is certain, will destroy any animal-substance with which they come in contact, and render even the poison of serpents inactive. By exhibiting a few doses of them, larger no doubt than what could be safely done on other occasions, we would be certain to change the state of the stomachic juices; and thus might free the patient from those intolerable spasms which always occasion death in such a short time. Dr Wolf seems inclined to think that volatile alkalies were of service; but the above hypothesis would incline us to use rather the fixed kind. At any rate, it seems vain for physicians to trust much to the power of opium, mercury, musk, or cinnabar, either singly or combined in any possible way. The bark has also failed, and the most celebrated specifics have been found ineffectual. Alkalies are the next most powerful remedies which the *materia medica* affords and they cannot be more unsuccessful than the others have generally been.

Another remedy which seems adapted to change the nature of the gastric juices is ardent spirits. In one of Dr Wolf's patients two bottles of brandy seem to have effected a cure, The oil mixed with it was of no efficacy in other cases, and the opium and turbith seem not to have been exhibited till the worst was past. In this case the disease seems to have attacked the vascular as well as the nervous system.

In all the patients the warm bath seems to have been a palliative, and a very powerful one, and as such it ought never to be omitted, though we can by no means trust to it as a radical cure; and the above histories abundantly show, that though the warm bath and opium may palliate for a short time, the cause on which

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which the spasms depend is still going on and increasing, till at last the symptoms become too strong to be palliated even for a moment by any medicine however powerful. At any rate, the abovementioned hypothesis suggests a new indication, which, if attended to, may perhaps lead to useful discoveries. In cases where putrescent bile is abundantly secreted, columbo root and vegetable acids are recommended to change the nature of the poison which the body is perpetually producing in itself. Where corrosive mercury hath been swallowed, alkaline salt is recommended to destroy the poison which nature cannot expel by vomiting; and why should not something be attempted to destroy the poison which the stomach seems to secrete in the hydrophobia, and which nature attempts to expel, though in vain, by violent efforts to vomit?

But whatever plan may be pursued in the hopes of curing this dreadful malady after any of the symptoms have made their appearance, we ought in every instance of the accident that gives rise to it, to direct our immediate care to *prevention*, as being perhaps the only real ground of hope: And the most certain and efficacious way of preventing the ill consequences, is instantly (if it may be done) to cut out the piece in the place that happens to be bitten. Dr James, indeed, says, that he would have little opinion of cutting or cauterising, if ten minutes were suffered to elapse from the receiving of the bite before the operation was performed. But in an inaugural dissertation lately published at Edinburgh by Dr Parry, the author is of opinion that excision will be of use a considerable time after the bite is received. He adopts this opinion from what happens in the small-pox, where the blood does not seem to receive the infection till some days after inoculation has been performed. A second inflammation, he tells us, then takes place, and the infection is conveyed into the blood. In like manner, when the hydrophobous infection is about to be conveyed into the blood according to him, the wound, or its cicatrix, begins again to be inflamed; and it is this second inflammation which does all the mischief. Excision, or the cautery, will therefore be effectual any time betwixt the bite and the second inflammation of the wound. Without implicitly trusting to this doctrine, however, or considering it as in any degree ascertained in what manner the poison diffuses itself, by what marks its progress may be known, or how soon the system may be irremediably tainted with its malignity, it is undoubtedly safest not to lose unnecessarily a moment's time in applying the knife. This, or a dilation of the wound if it be small, Dr Vaughan considers as the only prophylactics that can be depended upon. In the latter case, he directs to fill the wound with gunpowder, and set fire to it; which would produce a laceration of the part, and possibly the action of ignited powder upon the poison may have its use. In all cases, likewise, after these practices have been employed, the wound should be prevented from healing for some length of time.

324 Sp. II. The *Spontaneous* HYDROPHOBIA.

Hydrophobia spontanea, *Sauv.* sp. 2.

This disease very much resembles the former, so that it has undoubtedly been often mistaken for it. It has been known to come on from an inflammation of the stomach, where it was cured by repeated and large blood-letting; in hysteria, where it was cured by opium, musk, or other antispasmodics; and in putrid fevers, where it was cured by evacuating the intestinal canal of the putrid matters by repeated clysters. A very good method of distinguishing the two is, that in the spontaneous hydrophobia the patient is much more delirious than in the genuine species. In the instance mentioned in the Medical Essays of this symptom attending the inflammation of the stomach, the patient *raved in the most extraordinary manner*. Dr Raymond says he remembers a spontaneous hydrophobia *attended with madness*; and in almost all the cases of hydrophobia which are said to have been cured, the patient was very delirious. Dr Nugent's patient was very frequently delirious, and dreaded *dogs* as well as water. In the Medical Transactions a case is communicated by W. Wrightson surgeon in Sedgefield, Durham, of *canine madness* successfully treated. This madness indeed came on after the bite of a dog said to be mad: but it appeared only four days after the accident happened, and was attended with symptoms very unlike any of those abovementioned; for he suddenly started up in a fit of delirium, and ran out of the house, and after being brought in, caught hold of the hot bars of the grate which held the fire: Whereas, in the true hydrophobia, the patients dread the fire, light, or any thing which makes a strong impression on the senses, exceedingly. It is probable, therefore, that this was only a spontaneous hydrophobia, especially as it readily yielded to venesection, 30 drops of laudanum, and pills of a grain and an half of opium given every three hours, some boluses of musk and cinnabar, &c. while in some of the former cases as much opium was given to a boy as would have deprived of life the strongest healthy man had he swallowed it; and yet this amazing quantity produced scarce any effect. This patient also dreaded the sight of a dog.

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ORDER IV. VESANIÆ 325

Paranoiæ, *Vog.* Class IX.
Deliria. *Sauv.* Class VIII. Ord. III. *Sag.* Class XI. Ord. III.
Ideales, *Lin.* Class V. Ord. I.

GENUS LXV. AMENTIA. 326
FOLLY, or *Idiotism.*

Amentia, *Sauv.* gen. 233. *Vog.* 337. *Sag.* 346.
Morosis, *Lin.* 106.
Stupiditas, Morosis, Fatuitas, *Vog.* 336.
Amnesia, *Sauv.* gen. 237. *Sag.* 347.
Oblivio, *Lin.* 107. *Vog.* 338.
Memoriæ debilitas, *Junck.* 120.

GENUS LXVI. MELANCHOLIA. 327
MELANCHOLY *Madness.*

Melancholia, *Sauv.* gen. 234. *Lin.* 71. *Vog.* 332. *Sag.* 347. *Boerh.* 1089. *Junck.* 121.
Dæmonomania, *Sauv.* gen. 236. *Sag.* 348.
Dæmonia, *Lin.* 69.
Vesania. *Lin.* 70.
Paraphobia, *Lin.* 75.
Athymia, *Vog.* 329.

Deli-

Vesaniæ

Delirium melancholicum, *Hoffm.* III. 251.
Erotomania, *Lin.* 82.
Nostalgia, *Sauv.* gen. 226. *Lin.* 83. *Sag.* 338. *Junck.* 125.
Melancholia nervea, *Cl. Lorry* de melancholia, P. I.

328 GENUS LXVII. MANIA.
RAVING or FURIOUS *Madness.*

Mania, *Sauv.* gen. 235. *Lin.* 68. *Vog.* 331. *Sag.* 349. *Boerh.* 1118. *Junck.* 122. *Battie* on Madness.
Paraphrosyne, *Lin.* 66.
Amentia, *Lin.* 67.
Delirium maniacum, *Hoffm.* III. 251.

Although these distempers may be considered as distinct genera, yet they are so nearly allied, and so readily change into each other, that it sufficiently justifies the treating all of them together.

The distinguishing characteristic of madness, according to Dr Battie, is a *false perception;* and under this general character may be comprehended all kinds of what is called *madness*, from the most silly stupidity and idiotism to the most furious lunacy. Frequently the different kinds of madness are changed into each other by the casual excitement of some passion: thus, an idiot may become furiously mad, by being put in a violent passion; though this does not so often happen as the change of melancholy into the raving madness, and *vice versa.*

It is a very surprising circumstance, that mad people are not only less liable to be seized with infectious, disorders than those who are in perfect health; but even when labouring under other diseases, if the patients chance to be seized with madness, they are sometimes freed from their former complaints. Of this kind Dr Mead relates two very remarkable instances.

On the other hand, it has been known, that an intermittent fever, supervening madness of long standing, has proved a cure for the madness; the senses having returned when the fever terminated. Dr Monro saw two instances of this himself; and mentions it as an observation of his predecessor in the care of Bethlem hospital.

Another remarkable circumstance is, that immoderate joy, long continued, as effectually disorders the mind as anxiety and grief. For it was observable in the famous South-Sea year, when so many immense fortunes were suddenly gained, and as suddenly lost, that more people had their heads turned, from the prodigious flow of unexpected riches, than from the entire loss of their whole substance.

Mad people, especially of the melancholic kind, sometimes obstinately persevere in doing things which must excite great pain; whence it should seem as if their minds were troubled with some distracting notions, which make them patiently bear the present distress, lest more severe tortures should be inflicted; or possibly they may think, that, by thus tormenting the body, they render themselves more acceptable to the divine Being, and expiate the heinous sins of which they may imagine themselves to have been guilty.

It is, however, also highly probable, that their feelings differ exceedingly from what they are in a natural state; at least they are every day observed to endure; apparently without the smallest uneasiness, watching, hunger, and cold, to an extent which in a state of health would not only be highly distressing, but to the greater part of individuals would even prove fatal. And this resistance of hunger, cold, and sleep, affords perhaps the best test for distinguishing cases of real insanity, from cases where the disease is only feigned, and appearances of it put on, to answer particular purposes; at least where this power of resistance is present, we have good reason to conclude that the affection is not feigned.

Mania.

Cure. Although we be well acquainted with many of the remote causes of this disease, some of the principal of which have already been mentioned, yet we are still so ignorant of the influence of these upon the system, as giving a derangement of the mental faculties, that no general principles on which the cure may be conducted, can with any confidence be pointed out.

It may, however, be observed, that while some remedies seem to operate by producing an artificial termination of this complaint, many others have effect only as aiding a natural termination. And where a recovery from this disease does take place, it most frequently happens in consequence of a natural convalescence. All the species and degrees of madness which are hereditary, or that grow up with people from their early youth, are out of the power of physic; and so, for the most part, are all maniacal cases of more than one year's standing, let them arise from what source soever. Very often mere debility, the dregs of some particular disease, such as an ague, the small-pox, or a nervous fever, shall occasion different degrees of foolishness or madness. In these cases, the cure must not be attempted by evacuations; but, on the contrary, by nourishing diet, clear air, moderate exercise, and the use of wine: whereas, in almost all the other maniacal cases, which arise from different sources, and which come on in consequence of intemperate living, violent passions, or intense thinking, it is generally held, that evacuations of every kind are necessary, unless the constitution of the patient be such as absolutely forbids them.

Blood is most conveniently drawn either from the arm or jugulars; and if the weakness be such as renders it improper to take away much blood, we may apply cupping-glasses to the occiput.

Vomiting, in weakly people, must be excited by the vinum ipecacuanæ; but in the more robust by emetic tartar or antimonial wine: the most efficacious cathartics are the infusion or tincture of black hellebore, or infusion of sena quickened with tincture of jalap; but if there be suppression of the menses, or hæmorrhoidal discharge, then aloetic purges will be more proper; and in some instances cooling saline purgatives, such as lixiviated tartar, are of great service. In general, mad people require very large doses, both of the emetics and cathartics, before any considerable operation ensues.

Dr Monro assures us, that the evacuation by vomiting is infinitely preferable to any other: the prodigious quantity of phlegm with which the patients in this disease abound, he says, is not to be got the better of but by repeated emetics; and he observes, that the purges have not their right effect, or do not operate to so good purpose, until the phlegm be broken

and attenuated by frequent emetics. He mentions the case of a gentleman who had laboured under a melancholy for three years, from which he was relieved entirely by the use of vomits and a proper regimen. Increasing the discharge by urine, is also of the greatest moment, especially when any degree of fever is present. The cutaneous discharges are also to be promoted; for which purpose the hot bath is of the highest service in manaical cases. Hoffman asserts, that he has seen numerous instances, both of inveterate melancholy and raging madness, happily cured by means of warm bathing; bleeding and nitrous medicines having been premised. Camphor has also been highly commended; but, if we can believe Dr Locker of Vienna, not very deservedly. Having found very good effects from a solution of this medicine in vinegar, he took it for granted that all the success was owing to the camphor; therefore, in order to give it a fair trial, he selected seven patients, and gave it in large doses of half a drachm twice a-day. This was continued for two months, and the doctor was surprised to find that only one of his patients received any benefit. He then returned the other six back to the camphorated julep made with vinegar, and in a few weeks four of them recovered the use of their reason. This inclined him to think that the virtue depended solely on the vinegar, and accordingly he began to make the trial. Common vinegar was first given: but after a little while he fixed on that which had been distilled, and gave about an ounce and half of it every day; the patients having been previously prepared by bleeding and purging, which was repeated according as it was found necessary. He gives a list of eight patients who were cured by this method; some in six weeks, others in two months, and none of them took up more than three months in perfecting the cure. He does not indeed give the ages of the patients, nor mention the circumstances of the case; he only mentions the day on which the use of the vinegar was begun and the day on which they were discharged; and he adds, that they all continued well at the time of his writing.

Dr Locker informs us, that this medicine acts chiefly as a sudorific; and he observed, that the more the patients sweated, the sooner they were cured: it was also found to promote the menstrual discharge in such as had been obstructed, or had too little of this salutary evacuation.

Both reason and experience show the necessity of confining such as are deprived of their senses; and no small share of the management consists in hindering them to hurt themselves or do mischief to other persons. It has sometimes been usual to chain and to beat them: but this is both cruel and absurd; since the contrivance called the *strait waistcoat* answers every purpose of restraining the patients without hurting them.

These waistcoats are made of ticken, or some such strong stuff; are open at the back, and laced on like a pair of stays; the sleeves are made tight, and long enough to cover the ends of the fingers, where they are drawn close with a string like a purse, by which contrivance the patient has no power of his fingers; and, when laid on his back in bed, and the arms brought across the chest, and fastened in that position by tying the sleeve-strings round the waist, he has no use of his hands. A broad strap of girth-web is then carried across the breast, and fastened to the bedstead, by which means the patient is confined on his back; and if he should be so outragious as to require further restraint, the legs are secured by ligatures to the foot of the bed; or they may be secured by being both put into one bag not very wide, which may be more easily fixed than the feet themselves, at least without giving pain.

It is of great use in practice to bear in mind, that all mad people are cowardly, and can be awed even by the menacing look of a very expressive countenance; and when those who have charge of them once impress them with the notion of fear, they easily submit to any thing that is required. The physician, however, should never deceive them in any thing, but more especially with regard to their distemper: for as they are generally conscious of it themselves, they acquire a kind of reverence for those who know it; and by letting them see that he is thoroughly acquainted with their complaint, he may very often gain such an ascendant over them that they will readily follow his directions.

It is a more difficult matter to manage those whose madness is accompanied either with excessive joy or with great dejection and despondency, than those who are agitated with rage: and all that can be done is to endeavour to excite contrary ideas, by repressing the immoderate fits of laughter in the one kind by chiding or threatening (taking care, however, not absolutely to terrify them, which can never be done without danger, and has often added to the misery of the unhappy sufferer); and dispelling the gloomy thoughts in the other, by introducing pleasing concerts of music, or any other species of entertainment which the patients have been known to delight in while they had the use of their reason.

Though blistering the head has generally been directed, Dr Mead says he has oftener found it to do harm than service: but he recommends issues in the back; and advises to keep the head always close shaved, and to wash it from time to time with warm vinegar. Opium has by many been forbidden in maniacal cases, as supposing that it always increases the disturbance; but there are instances where large doses of this medicine have been found to prove a cure, and perhaps if it were tried oftener we should find powerful effects from it: there certainly cannot much harm ensue from a few doses, which may be immediately disused if they should be found to exasperate the disease.

The diet of maniacal patients ought to be perfectly light and thin: their meals should be moderate; but they should never be suffered to live too low, especially while they are under a course of physic: they should be obliged to observe great regularity in their hours: even their amusements should be such as are best suited to their disposition; and after the disease appears to be subdued, chalybeate waters and the cold bath will be highly proper to strengthen their whole frame and secure them against a relapse.

Vesaniæ

329 GENUS LXVIII. ONEIRODYNIA.
UNEASINESS in SLEEP.

Somnium, *Vog.* 339.
Somnambulismus, *Sauv.* gen. 221. *Lin.* 77. *Sag.* 333.
Hypnobatasis, *Vog.* 340.
Noctambulatia, *Junck.* 124.
Ephialtes, *Sauv.* gen. 138. *Lin.* 163. *Sag.* 245.
Incubus, *Vog.* 221. *Junck.* 50.

The greatest uneasiness which people feel in sleep is that commonly called the *incubus* or *night-mare*. Those seized with it seem to have a weight on their breasts and about their præcordia. Sometimes they imagine they see spectres of various kinds which oppress or threaten them with suffocation. Neither does this uneasiness continue only while they are asleep; for it is some time after they awake before they can turn themselves in their beds or speak; nay, sometimes, though rarely, the distemper has proved mortal.—The incubus rarely seizes people except when the stomach is oppressed with aliments of hard digestion, and the patient lies on his back. It is to be cured by eating light suppers, and raising the head high; or, if it become very troublesome, antispasmodic medicines are to be administered, and the body strengthened by chalybeates. The same method is to be followed by those who are subject to walking in their sleep; a practice which must necessarily be attended with the greatest danger; and somnambulism may justly be considered as merely a different modification of this disease. Accordingly Dr Cullen has distinguished the one by the title of *oneirodynia activa*, and the other by that of *oneirodynia gravans*.

330 CLASS III. CACHEXIÆ.

Cachexiæ, *Sauv.* Class X. *Sag.* Class VIII. *Sag.* Class III.
Deformes, *Lin.* Class X.

331 ORDER I. MACRORES.

Macies, *Sauv.* Class X. Order I. *Sag.* Class III. Order I.
Emaciantes, *Lin.* Class X. Order I.

332 GENUS LXIX. TABES.
WASTING of the *Body*.

Tabes, *Sauv.* gen. 275. *Lin.* 209. *Vog.* 306. *Sag.* 100.

This disorder is occasioned by the absorption of pus from some ulcer external or internal, which produces an hectic fever. The primary indication therefore must be to heal the ulcer, and thus take away the cause of the disease. If the ulcer cannot be healed, the patient will certainly die in an emaciated state. But the proper treatment of the tabes proceeding from this cause, falls to be considered under the head of *Ulcer* in SURGERY, and likewise under the genera SIPHYLIS, SCROFULA, SCORBUTICS, &c. diseases in which ulcers are least a very common symptom.

Atrophia.

GENUS LXX. ATROPHIA. 333
NERVOUS CONSUMPTION.

Description. This affection consists principally in a wasting of the body, without any remarkable fever, cough, or difficulty of breathing; but attended with want of appetite and a bad digestion, whence the whole body grows languid, and wastes by degrees.—Dr Cullen, however, asserts, that some degree of fever, or at least of increased quickness of the pulse, always attends this disease.

Causes. Sometimes this distemper will come on without any evident cause. Sometimes it will arise from passions of the mind; from an abuse of spirituous liquors; from excessive evacuations, especially of the semen, in which case the distemper hath got the name of *tabes dorsalis*. It may arise from mere old age, or from famine,

Prognosis. This distemper, from whatever cause it may arise, is very difficult to cure, and often terminates in a fatal dropsy.

Cure. The general principles on which the treatment of this disease is to be regulated, very much depend on the cause by which it is induced; and it is unnecessary to add, that this must be removed as far as possible. Next to this, the disease is most effectually combated by the introduction of nutritious aliment into the system, and by obtaining the proper assimilation and digestion of this. With the first of these intentions, recourse must be had to the diet that is most nutritious, and at the same time of easiest digestion. But from the condition of the stomach commonly attending this disease, it is necessary small quantities only should be taken at a time, and that it should be frequently repeated. With the second intention, stomachic and nervous medicines are the articles chiefly at least to be depended upon in this case. The Peruvian bark, elixir of vitriol, and chalybeates, are excellent; and these should be conjoined with gentle exercise, as far as the strength and other circumstances of the patient will admit. In that species of the distemper occasioned by venereal excesses, it is so essentially necessary to abstain from them, that without it the best remedies will prove altogether useless. But this is so seldom complied with, that the tabes dorsalis almost always proves mortal.

ORDER II. INTUMESCNTIÆ. 334

Intumescentiæ, *Sauv.* Class X. Ord. II. *Sag.* Class III. Ord. II.
Tumidosi, *Lin.* Class X. Ord. II.

GENUS LXXI. POLYSARCIA. 335
CORPULENCY.

Polysarcia, *Sauv.* gen. 279. *Lin.* 213. *Vog.* 240. *Sag.* 160. Steatites, *Vog.* 390.

In a natural and healthy state, the fat or animal oil, is not allowed to diffuse itself throughout the cellular interstices at large, but is confined to the places where such an oily fluid is necessary, by a particular apparatus of distinct vesicles. But in some constitutions the oily part of the blood appears to exceed the requisite proportion, and easily separates from the other con-

Intumescentiæ

constituent parts; or there is an uncommon tendency to the separation of oily matter. In these cases it is apt to accumulate in such quantities, that we may suppose it to burst those vesicles which were originally destined to hinder it from spreading too far; or almost every cell of the membrana adiposa, many of which are in ordinary cases altogether empty, may be completely filled with fat.

The increase of the omentum particularly, and the accumulation of fat about the kidneys and mesentery, swell the abdomen, and obstruct the motions of the diaphragm; whence one reason of the difficulty of breathing which is peculiar to corpulent people; while the heart, and the large vessels connected therewith, are in like manner so encumbered, that neither the systaltic nor subsultory motion can be performed with sufficient freedom, whence weakness and slowness of the pulse: but when the whole habit is in a manner overwhelmed with an oily fluid, the enlargement of the cellular interstices will necessarily interrupt the general distribution and circulation throughout the nervous and vascular systems; impeding the action of the muscular fibres, and producing insensibility, somnolency, and death.

These cases are the more deplorable, as there is but little prospect of a cure. For the animal oil is of too gross a nature to be easily taken up by absorption; and we know, that when fluids are accumulated in the cellular system, there are only two ways in which they can be carried off or escape; namely, by the absorbents, which take their rise from the cellular interstices, and through the pores of the skin by transudation.

Another misfortune is, that the disease steals on so imperceptibly, that it becomes inveterate before people begin to think of pursuing the proper means of relief.

In this disease the cure must turn upon two points: First, on preventing the farther deposition of fat, by avoiding the introduction of superfluous aliment, particularly of fatty matters, into the system; and, secondly, on promoting and forwarding the absorption of fat. On these grounds, besides what may be done by proper regimen, a variety of articles have been recommended in the way of medicine.

Soap has been proposed as a remedy to melt down and facilitate the absorption of the fat in corpulent people; and Dr Fleming some years ago published a little treatise, wherein he recommends this medicine, and relates the case of a gentleman who is said to have received considerable benefit from it. But perhaps the soap-leys would be more powerful, and might be more easily taken, sheathed, as directed when recommended as a dissolvent of the stone.

Lieutaud advises to take *acetum scilliticum* in small doses, with frequent purging and brisk exercise. But it will seldom happen that the patients will be found sufficiently steady to persist in any of these courses, it being the nature of the disorder to render them irresolute and inattentive to their condition. Therefore the principal use of rules must be with a view to prevention; and persons who are disposed to corpulency should take care in time to prevent it from becoming an absolute disease, by using a great deal of exercise, not indulging in sleep, and abridging their meals, especially that of supper. Salted meats are less fattening than such as are fresh; and drinking freely of coffee is recommended to corpulent people.

Polysarcia.

But Dr Fothergill observes, that a strict adherence to vegetable diet reduces exuberant fat more certainly than any other means that he knows; and gives two cases wherein this regimen succeeded remarkably well. The famous Dr Cheyne brought himself down in this way, from a most unwieldy bulk to a reasonable degree of weight; as he himself informs us. It deserves, however, to be remarked, that every practice for the removal or prevention of fatness must be used with great caution and prudence: for not a few, anxious to prevent this affection, have had recourse to a regimen and to medicine which have proved fatal. This has particularly arisen from the excessive use of acids, probably operating by entirely destroying the action of the chylopoietic viscera.

Genus LXXII. PNEUMATOSIS. 336
Emphysema, or *Windy Swelling*.

Pneumatosis, *Sauv.* gen. 280. *Vog.* 391. *Sag.* 107.
Emphysema, *Sauv.* gen. 13. *Lin.* 288. *Vog.* 392.
Leucophlegmatia, *Lin.* 214.

The emphysema sometimes comes on spontaneously; but more frequently is occasioned by wounds of the lungs, which giving vent to the air, that fluid insinuates itself into the cellular texture, and often blows it up to a surprising degree. It must be observed, however, that it is only in cases of laceration of the lungs where this disease can take place; for in a simple wound, the effusion of blood always prevents the air from getting out. The cure is to be accomplished by scarifications and compresses; but in some cases only by the paracentesis of the thorax. When air introduced from the lungs is collected in a considerable quantity in the cavity of the thorax, the operation of the paracentesis is perhaps the only means of cure. Upon an opening being thus made, the air sometimes rushes out with incredible violence; and the patient receives at least immediate relief from circumstances the most distressing imaginable. In some instances it is followed even by a complete cure.

Genus LXXIII. TYMPANITES. 337
Tympany.

Tympanites, *Sauv.* gen. 291. *Lin.* 219. *Vog.* 316 *Sag.* 118. *Boerh.* 226. *Junck.* 87.
Affectio tympanitica, *Hoffm.* III. 339.
Meteorismus, *Sauv.* gen. 292.

This is an inflation of the abdomen, and is of two kinds: 1. That in which the flatus is contained in the intestines, in which the patient has frequent explosions of wind, with a swelling of the belly frequently unequal. 2. When the flatus is contained in the cavity of the abdomen; in which case the swelling is more equal, and the belly sounds when struck, without any considerable emission of flatus. Of these two, however, the former disease is by much the most common; insomuch, that many, even extensively engaged in practice, have never met with an instance of true abdominal tympanites. In both cases the rest of the body falls away.

Causes,

Intumescentiæ

Causes, &c. The tympany sometimes takes place in those who have been long troubled with flatulencies in the stomach and intestines. It happens frequently to women after abortion; to both sexes after the suppression of the hæmorrhoids; and sometimes from tedious febrile disorders injudiciously treated.

Prognosis. This disease is generally very obstinate, and for the most part proves fatal by degenerating into an ascites. Sometimes, if the patient be healthy and strong, the disease may terminate favourably, and that the more readily if it has followed from some disorder. A hectic consumption, dry cough, and emaciated countenance in a tympany, with a swelling of the feet, denote approaching death in a very short time.

Cure. With a view to the prevention of this affection, it is necessary, in the first place, to avoid, as far as it can be done, causes giving rise to an uncommon extrication of air, by preserving the proper tone of the alimentary canal. After this affection has taken place, the indications are, first, to expel the air already extricated and confined in different cavities; and, secondly, to prevent further accumulation. On these grounds different remedies are employed. The cure, however, is principally attempted by carminative, resolvent, and stomachic medicines, gentle laxatives, and at last tonics, especially chalybeates. In the Edinburgh Medical Essays, Vol. I. we have a very remarkable hystory of a tympany by Dr Monro senior. The patient was a young woman of 22 years of age, who fell into the distemper after having a tertian ague, in which she was badly treated. She became a patient in the Edinburgh Infirmary the 24th of March 1730; took several purgatives; and some doses of calomel; used the warm bath; and had an antihysteric plaster applied over the whole belly, but with very little effect. She was monstrously distended, insomuch that the skin seemed to be in danger of bursting: her breathing was much straitened; but the swelling sometimes gradually decreased without any evacuation. The returns and degree of this swelling were very uncertain; and when the belly was most detumefied, several unequal and protuberant balls could be felt over the whole abdomen, but especially at its sides. Her stomach was good, she had no thirst, and her urine was in proportion to the quantity she drank. She was very costive, had her menses at irregular periods, but no œdematous swellings appeared in the feet or any where else. In this situation she continued from the time of her admission till the 21st of June, during which interval she had only her menses twice. Throughout this space of time, the following circumstances were observed, 1. Several times, upon the falling of the swelling, she complained of a headach; once of pains throughout all her body, once of a giddiness, twice of a nausea and vomiting, and the last time threw up green bile; and once her stomach swelled greatly, whilst the rest of the abdomen subsided. 2. During the flowing of the menses she did not swell, but became very big upon their stopping. 3. Blood-letting and emetics, which were made use of for some accidental urgent symptoms, had no very sensible effect in making the tympany either better or worse. 4. She never had passage of wind either way except a little belching some days before the first monthly evacuation.

Tympanites.

Some time before the last eruption of the menses, the purgatives were given more sparingly; and antihysterics of the strongest kinds, such as asafœtida, oleum corn. cerv. &c. mixed with soap, were given in large doses, accompanied with the hotter antiscorbutics as they are called, as horse-radish and ginger-root infused in strong ale with steel. The patient was ordered to use frequent and strong frictions to all the trunk of her body and extremities, and to use moderate exercise. Immediately before the menstrua began to flow, clysters of the same kind of medicines were injected. The menses were in sufficient quantity; but as soon as they ceased, her belly increased in its circumference four inches and a half, but soon subsided. She then complained of pains, which a gentle sweat carried off. Borborygmi were for the first time observed on the same day, June 25th; and having taken some *tinctura sacra* at night, she passed a small quantity of blood by stool. This was the first appearance of the return of the hæmorrhoids, to which she had been formerly subject.

The two following days her saponaceous, antihysteric, and antiscorbutic medicines being still continued, she had such explosions of wind upwards and downwards, that none of the other patients would remain in the same room, nay scarce on the same floor with her. Her belly became less and softer than it had been from the first attack of the disease; her medicines, with a dose of syrup of buckthorn at proper intervals, still were continued, only the proportion of steel was increased; her flatulent discharge went on successfully, and she gradually recovered her former health.

Genus LXXIV. PHYSOMETRA. 338
Windy Swelling of the Uterus.

Physometra, *Sauv.* gen. 290. *Sag.* 119.
Hysterophyse, *Vog.* 317.

The treatment of this is not different from that of the tympany. It is however, upon the whole, a very rare disease; and when it takes place, very seldom if ever admits of a cure.

Genus LXXV. ANASARCA. 339
Watery Swelling over the whole Body.

Anasarca, *Sauv.* gen. 281. *Lin* 215. *Vog.* 313. *Sag.* 108. *Boerh.* 1225. *Hoffm.* III. 322. *Junck.* 87. *Monro* on the Dropsy. *Millman* Animadversiones de hydrope 1779.
Phlegmatia, *Sauv.* gen. 282.
Angina aquosa, *Boerh.* 791.

In this disease the feet first begin to swell, especially in the evening, after exercise, and when the patient has stood or sat long; which swelling rises frequently to the thighs. By lying in bed, the swelling becomes less, or even almost disappears. In the progress of the disease, the swelling often rises to the hips, loins, and belly, and at last covers the whole body. This disease, besides the other symptoms afterwards mentioned under Ascites, is attended with a remarkable

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able difficulty of breathing. In the cure of this, as well as other species of dropsy, the general intentions are, first, the evacuation of the water already effused either by natural or artificial outlets; and, secondly, the prevention of it from accumulation, which is chiefly to be expected from supporting a due action of the absorbents, and from keeping up a proper discharge by the serous excretories.

The remedies employed with these intentions are much the same with what are employed against the more important genus of ascites. Only it may be here noticed, that in anasarca it is usual to scarify the feet and legs. By this means the water is often discharged: but the operator must be cautious not to make the incision too deep; they ought barely to penetrate through the skin; and especial care must be taken, by spirituous fomentations and proper digestives to prevent a gangrene. Dr Fothergill observes. that the safest and most efficacious way of making these drains is by the instrument used for cupping, called a *scarificator;* and he always orders it to be so applied as to make the little wounds transversely; as they not only discharge better, but are also longer in healing, than when made longitudinally.

Notwithstanding every precaution, however, gangrene will often ensue; and it is upon the whole a much safer practice to evacuate the water by the natural outlets, the valvular lymphatic absorbents; and with this intention emetics and cathartics, but particularly diuretics, are often employed with success.

340 GENUS LXXVI. HYDROCEPHALUS.
WATER in the HEAD.

Hydrocephalus, *Sauv.* gen. 285. *Lin.* 216. *Boerh.* 1217.
Hydrocephalum, *Vog.* 384.

THIS differs from the hydrocephalus formerly treated of at some length under the title of Apoplexia Hydrocephalica, chiefly in the water being collected in the external parts of the head, whereas the former is entirely within the skull. In the fifth volume of the Medical Observations we have an account of a very extraordinary case of this kind. The patient was a child only of a few days old, and had a tumor on his head about the size of a common tea-cup, which had the appearance of a bladder distended with water; near the apex was a small opening, through which a bloody serum was discharged. In other respects the child was healthy. No application was used but a piece of linen dipt in brandy. The tumor continued to increase for many months; at the end of which time the membrane containing the water appeared equally thick with the other part of the scalp, except one place about the size of a shilling, which continued thin, and at times appeared as if it would burst. He continued in this situation for about 17 months, when the circumference of the head was 20 inches, the base $16\frac{1}{2}$, the midde $11\frac{1}{2}$, and from the base to the apex near $8\frac{1}{2}$. The water was then drawn off, and the child died in two days. Almost all other cases of this distemper have proved fatal; the sutures of the skull generally give way, and the whole external part of the head is equally enlarged: but in the instance just now given there was a deficiency of part of the bones. Although however, in some instances where the head is thus enlarged to an enormous size, the water is exterior to the brain, and therefore intitled to the appellation of hydrocephalus exterior, yet much more frequently in those instances where there is a manifest separation of the bones of the cranium at the sutures, the water is still contained within the ventricles; and accordingly the disease may be much more properly distinguished into the *acute* and *chronic* hydrocephalus, than as is commonly done into the *internal* and *external*. Although the latter be much slower in its progress, sometimes subsisting even for years, yet it is equally difficult of cure with the former, and very often it proves fatal in a few days if the water be drawn off by an artificial opening, which may be very easily performed by a mere puncture with a common lancet, without either pain or any immediate hazard from the operation itself although the water be lodged in the venetricles; for these are distended to an enormous size, and the substance of the brain almost totally destroyed, so that hardly any thing is to be punctured but membranes.

Hydrocephalus.

GENUS LXXVII. HYDRORACHITIS. 341
SPINA BIFIDA.

Hydrorachitis, *Sauv.* gen. 287. *Morgagn.* de sed. XII. 9. *et seq.*
Spinola, *Lin.* 289.
Spina bifida, *Vog.* 386.

This disease, which consists in a soft tumor on the lumbar vertebræ, attended with a separation of the vertebræ themselves, though generally considered as approaching to the nature of rachitis, is commonly referred to the article SURGERY, which may be consulted with regard to this affection.

GENUS LXXVIII. HYDROTHORAX. 342
DROPSY of the BREAST.

Hydrothorax, *Sauv.* gen. 150. *Vog.* 311. *Boerh.* 1219.

This affection, particularly with respect to its causes, is in many circumstances similar to other kinds of dropsy, particularly to ascites. But from the situation of the water which is here deposited in the cavity of the thorax, it may naturally be supposed that some peculiar symptoms will occur. Besides the common symptoms of dropsy, paleness of the countenance, scarcity of urine, and the like, this disease is, in some instances, attended with a fluctuation of water within the breast; which when it does occur may be considered as a certain distinguishing mark of this affection. But besides this, it is also distinguished by the remarkable affections of circulation and respiration with which it is attended.

The breathing is peculiarly difficult, especially in a recumbent posture; and in many instances patients cannot breathe, with tolerable ease, unless when sitting erect, or even stooping somewhat forwards. The pulse is very irregular, and has often remarkable intermissions. But the disease has been thought to be principally characterized by a sudden starting from sleep, in consequence of an almost inexpressible uneasy sensation referred

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referred to the breast, and attended with strong palpitation, which may probably arise from an affection either of circulation or of respiration.

That these symptoms are common attendants of this disease is undeniable; and they are certainly the best characteristics of this affection with which we are yet acquainted: but it must be allowed that they are present in some cases where there is no water in the breast; and that in other instances where the disease exists, they are either altogether wanting, or occur only to a very slight degree. Certain diagnostics, therefore, of this disease still remain to be discovered.

When hydrothorax is present from the affection of the vital functions with which it is attended, it may readily be concluded that it is a dangerous disease, and in many instances it proves fatal. The cure, as far as it can be accomplished, is obtained very much on the same principle as in other dropsies. Here, however, probably from the uncertainty of the diagnostics, the artificial abstraction of water, by paracentesis of the thorax, is less frequently had recourse to than in ascites; though in some instances, after other means have failed, it has been said not only to give relief of symptoms highly urgent, particularly dyspnœa, but even to produce a complete cure. Benefit is often obtained from an artificial discharge of water by the application of blisters to the breast: but in this, as well as other dropsies, a discharge is chiefly effected by the natural outlets, particularly from the use of cathartics and diuretics. In this species of dropsy, more perhaps than in any other, recourse has been had to the use of the digitalis purpurea, or fox-glove, so strongly recommended as a diuretic by Dr Withering in his Treatise respecting the use of it. There can be no doubt that this article tho' sometimes productive of inconvenience from the distressing sickness and severe vomiting which it not unfrequently excites though used even but in small doses, often operates as a powerful diuretic, and produces a complete evacuation of water, after other articles have failed. From the effects mentioned above, however, as well as from its influence on the pulse, which it renders much slower, it is necessary that it should be employed with great caution and in small doses. A dram of the dried leaves of the digitalis, macerated for four hours in half a pint of warm water, forms an infusion which may be given in doses of an ounce, and the dried powder of the leaves in doses of one or two grains: these doses may be gradually increased, and repeated twice or oftener in the day; but this requires to be done with great caution, lest severe vomiting, or other distressing symptoms, should take place.

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Genus LXXIX. ASCITES.
Dropsy of the Abdomen.

Ascites, *Sauv.* gen. 288. *Lin.* 217. *Vog.* 314. *Sag.* gen. 115. *Boerh.* 1226. *Hoffm.* III. 322. *Junck.* 87. *D. Monro* on the Dropsy, 1765. *Milman*, Animadversiones de Hydrope, 1779.

Description. This disease assumes three different forms: 1. When the water immediately washes the intestines. 2. When it is interposed between the abdominal muscles and peritonæum; or, 3. When it is contained in sacs and hollow vesicles; in which case it is called the *encysted dropsy*. Some physicians of great reputation have asserted, that the water was often placed within the duplicature of the peritonæum: but this is alleged by Dr Milman to be a mistake, as that membrane is looked upon by the best anatomists to be single; and he thinks that the abovementioned physicians have been led into this error from observing the water collected in the cellular substance of the peritonæum.

Ascites.

In the beginning of an ascites the patient becomes languid, breathless, and has an aversion at motion: his belly swells; and when struck, the sound of fluctuating water is perceptible; there is a difficulty of breathing when the belly is pressed. There is an almost continual thirst, which in the progress of the disease becomes very urgent; the urine is thick, in small quantity, and red. The pulse is small and frequent; and as the body swells, the other parts waste away. A fever at last arises, which, constantly increasing, in the end carries off the patient. These symptoms are most urgent where the waters are in immediate contact with the intestines; in the other kinds the rest of the body is less wasted; nor is there so great thirst or difficulty of breathing.

Causes, &c. The immediate cause of dropsy is a greater effusion of serum by the exhalant arteries than the absorbents take up. This may be occasioned either by too great a quantity of liquid thrown out by the former, or by an inability of the latter to perform their office. This commonly happens in people whose bodies are of a weak and lax texture, and hence women are more subject to this malady than men; chlorotic girls especially are very apt to become dropsical.

Sometimes, however, this disease is occasioned by a debility of the vital powers, by great evacuations of blood, or by acute diseases accidentally protracted beyond their usual period; and although this cause seems very different from a laxity of fibres, yet the dropsy seems to be produced in a similar manner by both. For the vital powers being debilitated by either of these causes, naturally bring on a certain debility and laxity of the solids; and on the other hand a debility of the solids always brings on a debility of the vital powers; and from this debility of the vital powers in both cases it happens, that those humours which ought to be expelled from the body are not, but accumulate by degrees in its cavities. There is, however, this difference between the two kinds of dropsy arising from these two different causes, That in the one which arises from laxity the solid parts are more injured than in that which arises from a debility of the vital powers. In the former, therefore, the water seems to flow out from every quarter, and the body swells all over. But when the disease is occasioned by a debility of the vital powers, though the solids be less damaged, yet the power of the heart being much diminished, and the humours scarce propelled through the extreme vessels, the thin liquids, by which in a healthy state the body is daily recruited, are carried by their own weight either into the cavities or into the cellular texture. Hence those aqueous effusions which follow great evacuations of blood, or violent

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lent looseneſſes, begin in the more depending parts of the body, gradually aſcending, till they arrive at the cavity of the abdomen, or even the thorax.

But another and much more ſufficient cauſe for the production of dropſy is an obſtruction of the circulation; and this may take place from polypi in the heart or large veſſels, and hard ſwellings in the abdomen. Inſtances have been obſerved of a dropſy ariſing from ſteatomatous tumors in the omentum, and many more from a ſcirrhous liver or ſpleen, and from an infarction and obſtruction of the meſenteric glands, by which means the lymph coming from the extremities is prevented from arriving at the heart. Scirrhoſity of the liver, the moſt common cauſe of aſcites, probably operates by augmenting effuſion in conſequence of its preventing the return of the venous blood, the greater part of the veins from the abdomen going to the formation of the vena portarum.

Laſtly, whatever, either within or without the veſſels, contracts or ſhuts up their cavities, produces a more copious and eaſy tranſmiſſion of the thin humours through the exhalant arteries, at the ſame time that it prevents their return by the abſorbent veins. This has been eſtabliſhed by experiment. For Lower having perforated the right ſide of the thorax in a dog, tied the *vena cava*, and ſewed up the wound. The animal languiſhed for a few hours, and then died. On diſſection, a great quantity of ſerum was found in the abdomen, as if he had long laboured under an aſcites. In like manner, having tied the jugular veins of another dog, a ſurpriſing ſwelling took place in thoſe parts above the ligatures, and in two days the creature died. On diſſection, all the muſcles and glands were vaſtly diſtended, and quite pellucid, with limpid ſerum. From theſe experiments, and ſome caſes of the diſeaſe mentioned by different authors, it appears, that when the veins are obſtructed ſo that they cannot receive the arterial blood, the ſerum is ſeparated as by a filtre into the more open cavities and laxer parts of the body, while the thicker part ſtagnates and is collected in the proper blood-veſſels.

The too great tenuity of the humours is very frequently accuſed as the cauſe of dropſy, and many authors have aſſerted that dropſy might ariſe merely from a ſuperabundance of water in the blood. For this ſome experiments are quoted, from which they would infer, that when a great quantity of aqueous fluid is introduced into the blood, the ſuperfluous fluid ought by no means to paſs through the extremities of the ſanguiferous arteries into the veins in the common courſe of circulation, but by being effuſed into the cavities ſhould produce a dropſy. But this can only happen when the vital powers are very much diminiſhed; for, in a natural ſtate, the ſuperfluous quantity is immediately thrown out by the ſkin or the kidneys: and agreeable to this we have an expriment of Schultzius, who induced a dropſy in a dog by cauſing him drink a great quantity of water; but he had firſt bled him almoſt *ad deliquium*, ſo that the vital powers were in a manner oppreſſed by the deluge of water. In this manner do thoſe become hydropic who are ſeized with the diſeaſe on drinking large quantities of water either when wearied with labour, or weakened by ſome kinds of diſeaſes. Dr Fothergill relates an inſtance of a perſon who, being adviſed to drink plentifully of barley-water, in order to remove a fever, raſhly drunk 12 pounds of that liquor every day for a month, and thus fell into an almoſt incurable diſtemper. But if this quantity had been taken only during the prevalence of the fever, he would in all probability have ſuffered no inconvenience, as is probable from what has been related concerning the *diæta aquea* uſed by the Italians.

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It is moreover evident from experiments, that, in a healthy ſtate, not only water is not depoſited in the cavities, but that if it is injected into them it will be abſorbed, unleſs ſome laxity of the ſolids has already taken place. Dr Muſgrave injected into the right ſide of the thorax of a dog four ounces of warm water; whence a difficulty of breathing and weakneſs immediately followed. But theſe ſymptoms continually leſſened, and in the ſpace of a week the animal ſeemed to be in as good health as before. Afterwards he injected 16 ounces of warm water into the left cavity of the thorax in the ſame dog; the ſame effects followed, together with great heat, and ſtrong pulſation of the heart; but he again recovered in the ſpace of a week. Laſtly, he injected 18 ounces of water into one ſide of the thorax, and only ſix into the other: the ſame ſymptoms followed, but vaniſhed in a much ſhorter time; for within five days the dog was reſtored to perfect health. During this time, however, he obſerved that the creature made a greater quantity of urine than uſual.

The remote cauſes of dropſy are many and various. Whatever relaxes the ſolids in ſuch a manner as to give an occaſion of accumulation to the ſerous fluids, diſpoſes to the dropſy. A lazy indolent life, rainy wet weather, ſwampy or low ſoil, and every thing which conduces to vitiate the viſcera, or inſenſibly to produce obſtructions in them, paves the way for a dropſy. Hence thoſe are ready to fall into the diſeaſe who uſe hard and viſcid aliments, ſuch as poor people in ſome countries who uſe coarſe brown bread, and children who are fed with unwholeſome aliments; and the ſame thing happens to thoſe who drink immoderately of ſpirituous liquors.

Prognoſis. When the dropſy ariſes from a ſcirrhus of the liver or ſpleen, or any of the other viſcera, the prognoſis muſt always be unfavourable, and alſo when it ariſes from diſorders of the lungs. Neither is the caſe more favourable to thoſe in whom the ſmall veſſels are ruptured, and pour out their liquids into the cavity of the abdomen. Thoſe certainly die who have polypi in the veſſels, or tumors compreſſing the veins and veſſels of the abdomen. A dropſy ariſing from obſtructions in the menſenteric glands is likewiſe difficult to cure, whether ſuch obſtructions ariſe from a bad habit of body, or from any other cauſe; if we can, however, by any means remove the diſeaſe of the glands, the dropſy eaſily ceaſes. But in thoſe who fall into dropſy without any diſeaſe preceding, it is not quite ſo dangerous; and even though a diſeaſe has preceded, if the patient's ſtrength be not greatly weakened, if the reſpiration be free, and the perſon be not affected with any particular pain, we may entertain great hopes of a cure. But where a great loſs of blood is followed by a fever, and that by a dropſy, the patients almoſt always die, and

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that in a ſhort time: thoſe, however, are very frequently cured who fall into this diſeaſe without any preceding hæmorrhagy.

Cure. In the cure of this diſeaſe authors chiefly mention two indications. 1. To expel the ſuperfluous quantity of water; and, 2. To prevent its being again collected. But before we proceed to ſpeak of the remedies, it is neceſſary to take notice, that by the animal economy, if a great evacuation of a fluid takes place in any part of the body, all the other fluids in the body are directed towards that part, and thoſe which lie as it were lurking in different parts will be immediately abſorbed, and thrown out by the ſame paſſage. Hence the humours which in hydropic perſons are extravaſated into the different cavities of the body will be thrown into the inteſtines, and evacuated by purgatives; or by diuretics will be thrown upon the kidneys, and evacuated by urine. It is, however, not only neceſſary to excite theſe evacuations in order to remove this malady, but they muſt be aſſiduouſly promoted and kept up till the abundant humour is totally expelled. For this reaſon Sydenham has adviſed purgatives to be adminiſtered every day, unleſs, either through the too great weakneſs of the body, or the violent operation of the purgative, it ſhall be neceſſary to interpoſe a day or two now and then; becauſe if any conſiderable intervals be allowed to take place between the exhibition of the purgatives, an opportunity is given to the waters of collecting again. In this method, however, there is the following inconvenience, that, when the waters are totally evacuated, the ſtrength is at the ſame time ſo much exhauſted, that the diſtemper commonly returns in a very ſhort time. Hence almoſt our only hopes of curing a dropſy conſiſt in gently evacuating the waters by means of diuretics. But the efficacy of theſe is generally very doubtful. Dr Friend hath long ago obſerved, that this part of medicine is of all others the moſt lame and imperfect; but a French phyſician, Mr Bacher, lately diſcovered, as he alleges, a method of making the diuretics much more ſucceſsful. His reputation became at laſt ſo great, that the French king thought proper to purchaſe his ſecret for a great ſum of money. The baſis of his medicine was hellebore-root, the malignant qualities of which he pretended to correct in the following manner. A quantity of the dried roots of black hellebore were pounded, and then put into a glazed earthen veſſel, and afterwards ſprinkled with ſpirit of wine. They were ſuffered to ſtand for twelve hours, ſtirring them about twice or thrice during that ſpace of time. They were then ſprinkled again, and at laſt good Rheniſh wine was poured on till it ſtood ſix fingers above the roots. The mixture was frequently agitated with a wooden ſpatula; and as the wine was imbibed by the roots, more was poured on, ſo as to keep it always at the ſame height for 48 hours. The whole was then put on the fire and boiled for half an hour, after which the decoction was violently preſſed out; the ſame quantity of wine was added as at firſt, and the mixture boiled as before. After the ſecond expreſſion the woody reſiduum was thrown away as uſeleſs. Both the ſtrained liquors are then mixed together with two parts of boiling water to one of the decoction. The whole is afterwards evaporated in a ſilver veſſel to the conſiſtence of a ſyrup. One part of the extract is again added with two parts of boiling water, and the whole inſpiſſated as before.—By this means, ſays he, the volatile nauſeous acrid particles are ſeparated by evaporation, and the fixed ones remain corrected and prepared for medicinal uſes; adding, towards the end, a ninth part of old brandy, and evaporating to the conſiſtence of turpentine. Mr Bacher reaſons a good deal on the way in which this proceſs corrects the medicine; but tells us, that notwithſtanding the improvement, his pills will not have the deſired effect unleſs properly made up. For forming them, they ought to be mixed with matters both of an inviſcating and indurating nature; yet ſo prepared that it will be readily ſoluble in the ſtomach, even of a perſon already debilitated. For anſwering theſe purpoſes, he choſe myrrh and carrduus benedictus, and then gives the following receipt for the formation of his pills.

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"Take of the extract of hellebore prepared as above directed, and of ſolution of myrrh, each one ounce; of powdered carduus benedictus three drachms and a ſcruple. Mix them together, and form into a maſs, dividing it into pills of a grain and an half each." To theſe pills Mr Bacher gives the name of the *pilulæ tonicæ*, from an idea, that while they evacuate the water, they at the ſame time act as tonics; and thus from augmenting the action of the lymphatics, prevent the return of the diſeaſe. And if both theſe intentions could be effectually anſwered by the uſe of the ſame remedy, it would unqueſtionably be of great importance in practice.

The effects of theſe pills were, we are told, very ſurpriſing. Dr Daignan relates, that he gave them to 18 hydropic patients at once; and theſe he divided into three claſſes, according to the degree of the diſeaſe with which they were affected. The firſt claſs contained thoſe who laboured under an anaſarca following intermittent fevers. The ſecond claſs contained thoſe who had an anaſarca, together with ſome degree of aſcites, ariſing from tedious febrile diſorders. All theſe were cured; but theſe two claſſes conſiſted of ſuch caſes as are moſt eaſily removed. But the third contained ſix who were ſeized with a moſt violent anaſarca and aſcites, after being much weakened by tedious diſorders, and of conſequence in whom the diſeaſe was very difficult to be cured. Even of theſe, however, four were cured, and the other two died. The body of one of theſe being diſſected, both ſides of the cavity of the thorax were found to be full of a blackiſh-red water. The lungs were unſound; there was a polypous concretion in the right ventricle of the heart; the liver and ſpleen were hard, and of a preternatural bulk; and the glands of the meſentery were obſtructed and infarcted. In the other, the liver and pancreas were ſcirrhous, and the ſpleen very hard.

The ſame medicines were given by De Horne to eight perſons, ſix of whom had both an anaſarca and aſcites, but the other two only an aſcites. Four of theſe recovered; three died without being freed from the dropſy; one in whom the dropſy was cured died in a ſhort time after, having for ſome time before his death become ſpeechleſs.

By theſe patients 10 of the pills were taken at once;

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and the same dose repeated to the third time, with an interval of an hour betwixt each dose. At first they proved purgative, and then diuretic; by which last evacuation they finally cured the disease. But though Mr Bacher was firmly of opinion that his pills cured the dropsy by reason of the above-related correction; yet it is certain that, in the hands of other practitioners, these very pills have failed, unless they also made use of the same regimen recommended by that physician; while, on the other hand, it is also certain, that different medicines will prove equally efficacious in dropsical cases, provided this regimen is made use of.

For a great number of ages it has been recommended to dropsical patients to abstain as much as possible from drink, and thus to the torments of their disease was added that of an intolerable thirst; and how great this torment was, we may understand from an example of a friend of king Antigonus, who, having been closely watched both by order of the physicians and also of the king, was so unable to bear the raging thirst occasioned by his disease, that he swallowed his own excrements and urine, and thus speedily put an end to his life. Dr Milman shows at great length the pernicious tendency of this practice. He maintains that it is quite contrary to the sentiments of Hippocrates and the best ancient physicians. He asserts, that unless plenty of diluting drink be given, the best diuretics can have no effect. He condemns also in the strongest terms the practice of giving dropsical patients only dry, hard, and indigestible aliments. These would oppress the stomach even of the most healthy; and how much more must they do so to those who are already debilitated by labouring under a tedious disorder? By what means also are these aliments to be dissolved in the stomach when drink is with-held? In this disease the saliva is viscid, and in small quantity; from whence it may be reasonably conjectured, that the rest of the fluids are of the same nature, and the gastric juices likewise depraved. Thus the aliments lie long in the stomach; and if the viscera were formerly free of obstructions, they are now generated; the strength fails; perspiration and other excretions are obstructed; the viscid and pituitous humours produced by these kinds of food float about the præcordia, and increase the disease, while the surface of the body becomes quite dry. Nay, so much does this kind of diet conspire with the disease, that 100 pounds of fluid will sometimes be imbibed in a few days by hydropic persons who take no drink. Even in health, if the body from any cause becomes dry, or deprived of a considerable part of its juices, as by hunger, labour, &c. it will imbibe a considerable quantity of moisture from the air; so that we must impute the abovementioned extraordinary inhalation, in part at least, to the denial of drink, and to the nature of the aliment given to the sick. The following is the account given by Dr Milman of his practice in the Middlesex hospital.

If the patient be not very much debilitated, he is sometimes treated with the purging waters, and a dose of jalap and calomel alternately. On the intermediate days he gets a saline mixture, with 40 or 60 drops of *acetum scilliticum* every sixth hour; drinking with the purgatives oat-gruel and some thin broths. That he might the better ascertain what share the liquids given along with the medicines had in producing a copious flow of urine, he sometimes gave the medicines in the beginning of the distemper without allowing the drink: but though the swellings were usually diminished a little by the purgatives, the urine still continued scanty, and the patients were greatly weakened. Fearing, therefore, lest, by following this course, the strength of the sick might be too much reduced, he then began his course of diuretic medicines, giving large quantities of barley-water with a little *sal diureticus;* by which means, sometimes in the short space of 48 hours after the course was begun, the urine flowed out in very large quantity: but as saline drinks are very disagreeable to the taste, a drink was composed purposely for hydropic persons, of half an ounce of cream of tartar dissolved in two pounds of barley-water, made agreeably sweet with syrup, adding one or two ounces of French brandy.

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To this composition Dr Milman was induced by the great praises given to cream of tartar by some physicians in hydropic cases. In the *Acta Bononiensia*, 15 cases of hydropic patients are narrated who were cured only by taking half an ounce of cream of tartar daily. But it is remarkable, that by these very patients the cream of tartar was taken for 20, 30, nay 40 days, often without any perceptible effect; yet when dissolved in a large quantity of water, it showed its salutary effects frequently within as many hours, by producing a plentiful flow of urine. This liquor is now the common drink of hydropic patients in the hospital abovementioned, of which they drink at pleasure along with their medicines.

Among purgative medicines Dr Milman recommends the *radix senekæ;* but says the decoction of it, according to the Edinburgh Pharmacopœia, is too strong, as he always found it excite vomiting when prepared as there directed, and thus greatly to distress the patients: but when only half an ounce or six drachms of the root are used to a pound of decoction, instead of a whole ounce as directed by the Edinburgh college, he finds it an excellent remedy; and though it may sometimes induce a little vomiting, and frequently a nausea, yet it seldom failed to procure nine or ten stools a-day, and sometimes also proved diuretic. But we must take care not to be too free in the use of seneka, or any other purgative, if the patients be very weak; and therefore, after having used purgatives for some time, it will be proper to depend upon diuretics entirely for perfecting the cure; and of the success of this method our author gives some very remarkable instances. But he observes, that after the dropsy is removed, the patient will sometimes die without any evident cause; and of this it is proper that the physicians should be aware. It is remarkable with what ease a flux of urine is induced in those who have a scirrhous liver; while on the other hand, in one who had the mesenteric glands obstructed, along with a scirrhosity of the liver and vitiated state of the lungs, the most powerful diuretics proved ineffectual. In some cases Dr Milman thinks the kidneys may be so pressed with the weight of the water, as to be unable to perform their office. With regard, however, to diuretics in general, it may be remarked, that the operation of none of them can be certainly depended upon. In particular constitutions, and at particular times, one will be

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be obſerved to ſucceed, after another, though commonly much more powerful, has been tried in vain. Accordingly various articles of this kind are often uſed in ſucceſſion. Recourſe is particularly often had to the roots of taraxacum, of colchicum, and of ſquills; the latter, eſpecially when combined with calomel, is often found to be a very powerful diuretic. And indeed mercury in different forms probably from acting as a deobſtruent, is often of very great uſe in dropſical complaints. Among other diuretics, the lactuca viroſa has of late been highly extolled by Dr Collins of Vienna, and the nicotiana tabaccum by Dr Fowler of York: but neither has been extenſively introduced into practice, although we have known ſome inſtances in which the latter has been uſed with great advantage.

The water having been drawn off, we are to put the patient on a courſe of ſtrengtheners; ſuch as the Peruvian bark, with ſome of the warm aromatics, and a due proportion of rhubarb infuſed in wine and chalybeates. Gentle exerciſe, and frictions on the belly, with ſuch a courſe of diet as ſhall be light and nouriſhing, are alſo to be enjoined: and it may be obſerved, that the uſe of tonic medicines is by no means to be delayed till a complete evacuation of the water can be obtained. On the contrary, by alternating, and even combining the uſe of evacuants and tonics, the influence of both is often very much promoted.

When the patient can by no other means be relieved, the operation of paracenteſis muſt be had recourſe to, which is deſcribed under the article SURGERY.

344 GENUS LXXX. HYDROMETRA.
DROPSY of the *Uterus*.

Hydrometra, *Sauv.* gen. 289. *Sag.* 116. *Boerh.* 1224

345 GENUS LXXXI. HYDROCELE.
DROPSY of the *Scrotum*.

Oſcheocele, *Sauv.* gen. 41. *Vog.* 388.
Oſcheophyma, *Sag.* 44.
Hydrops ſcroti, *Vog.* 389.
Hydrops teſtium, *Boerh.* 1227.

For the treatment of theſe two diſeaſes, we may refer the reader to what has already been ſaid of other ſpecies of dropſy particularly aſcites. But both are chiefly to be combated by chirurgical operation, eſpecially the latter, in which it ſeldom fails to produce a complete cure.

346 GENUS LXXXII. PHYSCONIA.
SWELLING of the *Belly*.

Phyſconia, *Sauv.* gen. 283. *Vog.* 325. *Sag.* gen. 110.
Hypoſarca, *Lin.* 218.

This diſeaſe may ariſe from a variety of cauſes, as from a ſwelling of the liver, ſpleen, kidneys, uterus, omentum, ovarium, meſentery, inteſtines, &c. and ſometimes it ariſes merely from fat. In the former caſes, as the viſcera are generally ſcirrhous and indurated, the diſtemper is for the moſt part incurable; neither is the proſpect much better where the diſeaſe is occaſioned by a great quantity of fat.

GENUS LXXXIII. RACHITIS.
The RICKETS.

Rachitis.

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Rachitis, *Sauv.* gen. 294. *Lin.* 212. *Vog.* 312. *Sag.* gen. 120. *Boerh.* 1480. *Hoffm.* III. 487. *Zeviana.* della Rachitide. *Gliſſon.* de Rachitide.

Deſcription. This is one of the diſeaſes peculiar to infancy. It ſeldom attacks children till they are nine months, nor after they are two years old; but it frequently happens in the intermediate ſpace between theſe two periods. The diſeaſe ſhows itſelf by a flaccid tumor of the head and face, a looſe flabby ſkin, a ſwelling of the abdomen, and falling away of the other parts, eſpecially of the muſcles. There are protuberances of the epiphyſes of the joints; the jugular veins ſwell, while the reſt decreaſe; and the legs grow crooked. If the child has begun to walk before he be ſeized with this diſeaſe, there is a ſlowneſs, debility, and tottering in his motion, which ſoon brings on a conſtant deſire of ſitting, and afterwards of lying down; inſomuch that nothing at laſt is moveable but the neck and head. As they grow older, the head is greatly enlarged, with ample ſutures; the thorax is compreſſed on the ſides, and the ſternum riſes up ſharp, while the extremities of the ribs are knotty. The abdomen is protuberant, and the teeth black and carious. In ſuch patients as have died of this diſeaſe, all the ſolids appear ſoft and flaccid, and the fluids diſſolved and mucous,

Cauſes. The rickets may proceed from ſcrofulous or venereal taints in the parents, and may be increaſed by thoſe of the nurſe. It is likewiſe promoted by feeding the child with aqueous and mucous ſubſtances, crude ſummer-fruits, fiſh, unleavened farinaceous aliment, and too great a quantity of ſweet things.—Sometimes it follows intermittent fevers and chronic diſorders; and in ſhort is cauſed by any thing which tends to debilitate the body, and induce a viſcid and unhealthy ſtate of the juices.

Prognoſis. The rickets do not uſually prove fatal by themſelves, but if not cured in time, they make the perſon throughout life deformed in various ways; and often produce very pernicious diſorders, ſuch as carious bones in different parts of the body.

Cure. This is to be affected by mild cathartics, alteratives, and tonics, ſuch as are uſed in other diſeaſes attended with a debility of the ſyſtem and a vitiated ſtate of the blood and juices. In the Weſtern Iſlands of Scotland, the medicine uſed for the cure of the rickets is an oil extracted from the liver of the ſkate-fiſh. The method of application is as follows: Firſt, the wriſts and ankles are rubbed with the oil in the evening: this immediately raiſes a fever of ſeveral hours duration. When the fever from the firſt rubbing ſubſides, the ſame parts are rubbed again the night following; and repeatedly as long as the rubbing of theſe parts continues to excite the fever.—When no fever can be excited by rubbing the wriſts and ankles alone, they are rubbed again along with the knees and elbows. This increaſed unction brings on the fever again; and is practiſed as before, till it no longer has that effect. Then the vertebræ and ſides are rubbed, along with the former parts; and this

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this unction, which again brings on the fever, is repeated as the former. When no fever can be any longer excited by this unction, a flannel shirt dipped in the oil is put upon the body of the patient: this brings on a more violent and sensible fever than any of the former unctions; and is continued till the cure be completed, which it commonly is in a short time.

A German physician, Dr Strack, has lately published a paper, in which he recommends the filings of iron as a certain remedy in the rickets. This disease, he observes, in general begins with children when they are about 16 months old. It is seldom observed with children before they be one year old, and seldom attacks them after they pass two; and it is very generally worse where it begins early than where it begins late.

For effecting a cure, it is, he affirms, a matter of the utmost consequence to be able to distinguish, very early, whether a child will be afflicted with rickets or not. And this, he assures us may be determined by the following symptoms; paleness and swelling of the countenance; and in that part of the cheeks which should naturally be red, a yellow colour approaching to that of sulphur. When that is the case, he directs that a medicine should be immediately had recourse to which will retard the further progress of the disease and remove what has already taken place. For this purpose, he advises that five grains of the filings of iron, and as much rhubarb, should be rubbed up with ten grains of sugar, and given for a dose every morning fasting, and every evening an hour before supper. But if considerable looseness should be produced, it will be necessary, at first, to persist in the use of one dose only every day.

After a month's continuance in this course, according to Dr Strack, there in general ensues a keen appetite for food, quick digestion, and a copious flow of urine; by means of which the fulness of the face and yellowness of the complexion are by degrees removed, while the natural colour of the countenance and firmness of the body in general are gradually restored. This practice, he assures us, has never failed of success in any one instance; not even in those children born of parents greatly afflicted with the rickets.

In addition to the use of chalybeates, great benefit is often also obtained in this disease from the use of the cold bath; which, under prudent administration, is perhaps one of the most effectual remedies for this complaint with which we are yet acquainted.

When the bones of rickety children begin to bend, they may sometimes be restored to their natural shape by compresses, bolsters, and proper supports. See the article SURGERY.

348 ORDER III. IMPETIGINES.

Impetigines, *Sauv.* Cl. X. Ord. V. *Sag.* Cl. III. Ord. V.

349 GENUS LXXXIV. SCROFULA.
KING'S-EVIL.

Scrofula, *Sauv.* gen. 285. *Vog.* 367. *Sag.* 121. Struma, *Lin.* 284.

Description. This disease shows itself by hard, scirrhous, and often indolent tumors, which arise by degrees in the glands of the neck, under the chin, armpits, and different parts of the body, but most commonly in the neck, and behind the ears. In process of time, the cellular substance, ligaments of the joints, and even the bones themselves, are affected. In scrofula the swellings are much more moveable than those of the scirrhous kind; they are generally softer, and seldom attended with much pain; they are tedious in coming to suppuration; are very apt to disappear suddenly and again to rise in some other part of the body. We may likewise mention as characteristic circumstances of this disease, a remarkable softness of the skin, a kind of fulness of the face, generally with large eyes, and a very delicate complexion.

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Causes. A variety of causes have been mentioned as tending to produce scrofula; viz. a crude indigestible food; bad water; living in damp, low situations; its being an hereditary disease, and in some countries endemic, &c. But whatever may in different circumstances be the exciting or predisposing causes of the scrofula, the disease itself either depends upon, or is at least much connected with, a debility of the constitution in general, and probably of the lymphatic system in particular, the complaint always showing itself by some affections of the latter. And that debility has at least a considerable influence in its production is probable, not only from the manifest nature of some of the causes said to be productive of scrofula, but likewise from such remedies as are found most serviceable in the cure, which are all of a tonic invigorating nature.

Prognosis. The scrofula is a distemper which often eludes the most powerful medicines, and therefore physicians cannot with any certainty promise a cure. It is seldom, however, that it proves mortal in a short time, unless it attacks the internal parts, such as the lungs, where it frequently produces tubercles that bring on a fatal consumption. When it attacks the joints, it frequently produces ulcers, which continue for a long time, and gradually waste the patient; while in the mean time the bones become foul and corroded and death ensues after a long scene of misery. The prognosis in this respect must be regulated entirely by the nature of the symptoms.

Cure. It was long supposed that scrofula depended upon an acid acrimony of the fluids; and this, it is probable, give rise to the use of burnt sponge, different kinds of soap, and other alkaline substances, as the best remedies for acidity. But although a sourness in the stomach and *primæ viæ* does no doubt frequently occur in these complaints, yet this symptom seems to be entirely the consequence of that general relaxation which in scrofula so universally prevails, and which does not render it in the least necessary to suppose a general acescency of the fluids to take place; as the one very frequently, it is well known, even in other complaints occurs without the least suspicion of any acid acrimony existing after the other. This is also rendered very probable from the indolent nature of scrofulous tumors which have been known to subsist for years without giving any uneasiness; which could not have been the case, if an acid, or any other acrimony, had prevailed in them.

In the treatment of scrofula, different morbid conditions,

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ditions, existing in different parts, require, according to circumstances, various means of cure: but, upon the whole, the remedies directed may be considered as used with a view either to the tumors, to the ulcerations, or to the general state of the system.

Gentle mercurials are sometimes of use as resolvents in scrofulous swellings; but nothing has such considerable influence as a frequent and copious use of Peruvian bark. Cold bathing too, especially in the sea together with frequent moderate exercise, is often of singular service here; as is likewise change of air, especially to a warm climate.

In the scrofulous inflammation of the eyes, or ophthalmia strumosa, the Peruvian bark has also been given with extraordinary advantage: and we meet with an instance of its having cured the gutta rosacea in the face; a complaint which it is often difficult to remove, and which is extremely disagreeable to the fair sex.

From the various cases related of tumefied glands, it appears, that when the habit is relaxed and the circulation weak, either from constitution or accident, the bark is a most efficacious medicine, and that it acts as a resolvent and discutient. It will not, however, succeed in all cases; but there are few in which a trial can be attended with much detriment. Dr Fothergill observes, that he has never known it avail much where the bones were affected, nor where the scrofulous tumor was so situated as to be accompanied with much pain, as in the joints, or under the membranous coverings of the muscles; for when the disease attacks those parts, the periosteum seldom escapes without some injury, by which the bone will of course be likewise affected. Here the Peruvian bark is of no effect: instead of lessening, it rather encreases the fever that accompanies those circumstances: and if it do not really aggravate the complaint, it seems at least to accelerate the progress of the disease.

Various are the modes in which the bark is administered: Dr Fothergill makes use of a decoction with the addition of some aromatic ingredients and a small quantity of liquorice-root, as a form in which a sufficient quantity may be given without exciting disgust. But where is it easily retained in the stomach in substance perhaps the best form of exhibiting it is that of powder; and in this state it is often advantageously conjoined with powder of cicuta, an article possessing very great deobstruent powers.

The powder, however, soon becomes disagreeable to very young patients; and the extract seems not so much to be depended upon as may have been imagined. In making the extract, it is exposed to so much heat, as must have some effect upon its virtues, perhaps to their detriment. In administering it, likewise, if great care be not taken to mix it intimately with a proper vehicle, or some very soluble substance, in weak bowels it very often purges, and thereby not only disappoints the physician, but injures the patient. A small quantity of the *cortex Winteranus* added gives the medicine a grateful warmth; and a little liquorice, a few raisins, gum arabic, or the like added to the decoction before it be taken from the fire, by making the liquor viscid enables it to suspend more of the fine particles of the bark; by which process the medicine is not only improved in efficacy, but at the same time rendered less disagreeable.

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In indolent swellings of the glands from viscid humours, sea-water also has been strongly recommended by Dr Russel.

Dr Fothergill also acquaints us, that the cicuta even by itself is not without a considerable share of efficacy in removing scrofulous disorders. He mentions the case of a gentlewoman, about 28 years of age, afflicted from her infancy with scrofulous complaints, severe ophthalmies, glandular swellings, &c. cured by the *extractum cicutæ* taken constantly for the space of a year. He observes, however, that when given to children even in very small doses, it is apt to produce spasmodic affections; for which reason he rarely exhibits it to them when very young, or even to adults of very irritable habits.

Dr Fothergill gives several other instances of the success of cicuta in scrofulous cases, and even in one which seemed to be not far removed from a confirmed phthisis; but owns that it seldom had such good effects afterwards: yet he is of opinion, that where there are symptoms of tubercles forming, a strumous habit, and a tendency to phthisis, the cicuta will often be serviceable. It is anodyne, corrects acrimony, and promotes the formation of good matter. With regard to the quality of the medicine, he observes, that the extract prepared from hemlock before the plant arrives at maturity, is much inferior to that which is made when the hemlock has acquired its full vigour, and is rather on the verge of decline: just when the flowers fade, the rudiments of the seeds become observable, and the habit of the plant inclines to yellow. This, he thinks, is the proper time to collect the hemlock. It has then had the full benefit of the summer heat; and the plants that grow in exposed places will generally be found more active than those that grow in the shade. The less heat it undergoes during the preparation, the better. Therefore, if a considerable quantity of the dry powder of the plant gathered at a proper season be added, less boiling will be necessary, and the medicine will be the more efficacious. But let the extract be prepared in what manner soever it may, provided it be made from the genuine plant, at a proper season, and be not destroyed by boiling, the chief difference observable in using it is, that a larger quantity of one kind is required to produce a certain effect than of another. Twenty grains of one sort of extract have been found equal in point of efficacy to thirty, nay near forty, of another; yet both of them made from the genuine plant, and most probably prepared with equal fidelity. To prevent the inconveniences arising from this uncertainty, it seems always expedient to begin with small doses, and proceed step by step till the extract produces certain effects, which seldom fail to arise from a full dose. These effects are different in different constitutions. But, for the most part, a giddiness affecting the head, and motions of the eyes as if something pushed them outwards, are first felt; a slight sickness, and trembling agitation of the body; a laxative stool or two. One or all these symptoms are the marks of a full dose, let the quantity in weight be what it will. Here we must stop till none of these effects be felt; and in three or four days advance a few grains more. For it has been supposed by most of those who have used this medicine to any good purpose, that the cicuta seldom procures any

Impetigine any benefit, though given for a long time, unless in as large a dose as the patient can bear without suffering any of the inconveniences abovementioned. There is, however, reason to believe, that its effects as a discutient are in no degree dependent on its narcotic powers: and we are inclined to think, that recourse is often had to larger doses than are necessary; or at least that the same benefit might be derived from smaller ones continued for an equal length of time.

Patients commonly bear a greater quantity of the extract at night than at noon, and at noon than in the morning. Two drachms may be divided into thirty pills. Adults begin with two in the morning, two at noon, and three or four at night, with directions to increase each dose, by the addition of a pill to each, as they can bear it.

But after all, the best form under which the cicuta can, we think, be exhibited, is that of powder from the leaves. This, either in a state of powder or made into pills, may be given at first to the extent of four or five grains, and the dose gradually rising till it amount to 15 or 20 grains twice or thrice a day. Given to this extent, particularly when conjoined with the Peruvian bark, it has often been found of great service in scrofulous cases. At the same time it must be allowed, that such patients, after resisting every mode of cure, will have in some instances a spontaneous recovery in the progress of life, probably from the system acquiring additional vigour.

350 GENUS LXXV. SYPHILIS.
LUES VENEREA, or *French Pox.*

Syphilis, *Sauv.* gen. 3086. *Lin.* 6. *Vog.* 319. *Sag.* 126.
Lues venerea, *Boerh.* 1440. *Hoffm.* III. 413. *Junck.* 96. *Astruc* de lue Venerea.

Dr Astruc, who writes a very accurate history of the lues venerea, is fully convinced that it is a new disease, which never appeared in Europe till some time between the years 1494 and 1496, having been imported from America by the companions of Christopher Columbus; though this opinion is not without its opponents. Dr Sanches in particular has contended with much learning and ability, that it appeared in Europe at an earlier period: But it is at least certain, that it was altogether unknown to the medical practitioners of Greece and Rome, and that it was a very common disease in America when the Europeans first visited that country. But at whatever period it may have been introduced into Europe, or from whatever source it may have been obtained, there can be no doubt that, as well as small-pox or measles, syphilis depends on a peculiar specific contagion; or a matter *sui generis* which is alone capable of inducing this disease.

The venereal infection, however, cannot, like the contagious miasmata of the small-pox and some other diseases, be carried through the air, and thus spread from place to place: for unless it is transmitted from the parents to the children, there is no other way of contracting the disease but from actual contact with the infectious matter. Thus, when a nurse happens to labour under the disease, the infant that she suckles will receive the infection; as on the other hand, when the child is infected, the nurse is liable to receive it: and there have even been instances known of lying-in women being infected very violently, from having employed a person to draw their breasts who happened to have venereal ulcers in the throat. It may be caught by touching venereal sores if the cuticle be abraded or torn; and in this way accoucheurs and midwives have sometimes been infected severely. Dr Macbride says, the most inveterate pox he ever saw was caught by a midwife, who happened to have a whitelow on one of her fingers when she delivered a woman ill of the lues venerea. Syphilis.

But by far the most ready way of contracting this disease is by coition, the genital parts being much more bibulous than the rest of the body. When the disorder is communicated, the places where the morbific matter enters are generally those where it first makes its appearance; and as coition is the most usual way of contracting it, so the first symptoms commonly appear on or near the pudenda.

The patient's own account will, for the most part, help us to distinguish the disease: but there are sometimes cases wherein we cannot avail ourselves of this information, and where instead of confessing, the parties shall conceal all circumstances; while, on the other hand, there are now and then people to be met with, who persuade themselves that symptoms are venereal, which in reality are owing to some other cause: and therefore it is of the utmost importance to inform ourselves thoroughly of the nature of those symptoms and appearances which may be considered as pathognomic signs of lues venerea.

In the first place, when we find that the local symptoms, such as chancres, buboes, phymosis, and the like, do not give way to the usual methods; or when these complaints, after having been cured, break out again without a fresh infection; we may justly suspect that the virus has entered the whole mass of fluids: but if at the same time ulcers break out in the throat, and the face is deformed by callous tubercles, covered with a brown or yellow scab, we may be assured that the case is now become a confirmed lues, which will require a mercurial course.

When eruptions of the furfuraceous and superficial kind are venereal, they are not attended with itching; and the scale being picked off, the skin appears of a reddish brown or rather copper-colour, underneath; whereas leprous eruptions are itchy, throw off a greater quantity of scales, and rise in greater blotches, especially about the joints of the knees and elbows. Venereal tubercles or pustules are easily distinguished from carbuncles of the face, by not occupying the cheeks or the nose, nor as having a purulent apex, but are covered at top, either with a dry branny scruf like the superficial eruptions just now mentioned, or else with a hard dry scab of a tawney yellow hue; they particularly break out among the hair or near to it, on the forehead or on the temples.

Venereal ulcers affecting the mouth are distinguishable from those which are scorbutic in the following manner: 1. Venereal ulcers first affect the tonsils, fauces, and uvula; then the gums but these very rarely: on the contrary, scorbutic ulcers affect the gums first of all; then the fauces, tonsils, and uvula. 2. Venereal ulcers frequently spread to the nose; scorbutic ones almost never. 3. Venereal ulcers are callous in the

Impetigines the edges; scorbutic ones are not so. 4. Venereal ulcers are circumscribed, and, for the most part, are circular, at least they are confined to certain places; scorbutic ones are of a more irregular form, spread wider, and frequently affect the whole mouth. 5. Venereal ulcers are for the most part hollow, and generally covered at bottom with a white or yellow slough; but scorbutic ones are more apt to grow up into loose fungi. 6. Venereal ulcers are red in their circumference, but scorbutic ones are always livid. 7. Venereal ulcers frequently rot the subjacent bones, the scorbutic ones seldom or never. 8. And lastly, Venereal ulcers are mostly combined with other symptoms which are known to be venereal; scorbutic ones with the distinguishing signs of the scurvy, such as difficult breathing, listlessness, swelling of the legs, rotten gums, &c.

Another sure sign of the confirmed lues is often afforded from certain deep-seated nocturnal pains, particularly of the shins, arms, and head. As for any superficial wandering pains that have no fixed seat, and which affect the membranes of the muscles and ligaments of the joints, they, for they most part, will be found to belong to the gout or rheumatism, and can never be considered as venereal unless accompanied with some other evident signs; but with regard to the pains that are deeply seated, and always fixed to the same place, and which affect the middle and more solid part of the ulna, tibia, and bones of the cranium, and rage chiefly and with greatest violence in the forepart of the night, so that the patient can get no rest till morning approaches, these may serve to convince us that the disease has spread itself throughout the whole habit, whether they be accompanied with other symptoms of the lues or not. *Gummata* in the fleshy parts, *nodes* in the periosteum, *ganglia* upon the tendons, *tophi* upon the ligaments, *exostoses* upon the bones, and *fici* at the verge of the anus, are all of them signs of the confirmed lues: these are hard indolent swellings; but as they sometimes arise independently of any venereal infection, and perhaps may proceed from a scrofulous taint, unless they be accompanied or have been proceded by some of the more certain and evident symptoms of the lues, we must be cautious about pronouncing them venereal. When these swellings are not owing to the syphilitic virus, they are very seldom painful, or tend to inflame and suppurate; whereas those that are venereal usually do, and if they lie upon a bone generally bring on a caries.

These carious ulcers are most commonly met with upon the ulna, tibia, and bones of the cranium; and when accompanied with nocturnal pains, we can never hesitate about declaring their genuine nature. Frequent abortions, or the exclusion of scabby, ulcerated, half-rotten, and dead fetuses, happening without any manifest cause to disturb the fetus before its time, or to destroy it in the womb, may be reckoned as a sure sign that at least one of the parents is infected.

These then are the principal and most evident signs of the confirmed lues. There are others which are more equivocal, and which unless we can fairly trace them back to some that are more certain, cannot be held as signs of the venereal disease: Such are, 1. Obstinate inflammations of the eyes, frequently returning with great heat, itching, and ulceration of the eye-lids. Syphilis. 2. A singing and hissing noise in the ears, with ulcers or caries in the bones of the meatus auditorius. 3. Obstinate head-achs. 4. Obstinate cutaneous eruptions, of the itchy or leprous appearance, not yielding to the milder methods of treatment. 5. Swellings of the bones; and, 6. Wandering and obstinate pains. None of these symptoms, however, can be known to be venereal, except they happen to coincide with some one or other of the more certain signs.

It may, perhaps, be considered as a singularity in this disease, that the diagnosis is often more difficult in the advanced than in the early periods of the affection. That is, with those who have been certainly subjected to syphilis, it is often very difficult to say whether certain symptoms, remaining after the ordinary modes of cure have been employed, be syphilitic or not. Very frequently, as appears from the sequel, nocturnal pains, ulcerations, and the like, remaining after a long course of mercury has been employed, are in no degree of a venereal nature, but are in reality to be considered as consequences rather of the remedy than of the disease; and are accordingly best removed by nourishing diet, gentle exercise, and tonics. But as long as any symptoms of any kind remain, it is often impossible to convince some patients that they are cured; and it is often impossible for a physician with certainty to affirm that the disease is altogether overcome.

Upon the whole, we are first to distinguish and consider the several symptoms apart; and then, by comparing them with each other, a clear judgment may be formed upon the general review.

Prognosis. Being thoroughly convinced that the case is venereal, we are to consider, first of all, whether it be of a longer or shorter date; for the more recent it is, it will, *cæteris paribus*, be less difficult to remove. But there are other circumstances which will assist us in forming a prognostic as to the event. As,

1. The age of the patient. This disorder is more dangerous to infants and old people than to such as are in the flower and vigour of life, in whom some part of the virus may be expelled by exercise, or may be subdued in some degree by the strength of the constitution.

2. The sex. Though women are for the most part weaker than men, and therefore should seem less able to resist the force of any disease, yet experience shows that this is easier borne by them than by men; perhaps owing to the menstrual and other uterine discharges, by which a good share of the virus may be carried off immediately from the parts where it was first applied; for it is observable, that whenever these discharges are obstructed, or cease by the ordinary course of nature, all the symptoms of this disease grow worse.

3. The habit of body. Persons who have acrid juices will be liable to suffer more from the venereal poison than such as have their blood in a milder state; hence, when people of a scorbutic or scrofulous habit contract venereal disorders, the symptoms are always remarkably violent, and difficult to cure. And for the same reasons, the confirmed lues is much more to be dreaded in a person already inclined to an asthma, phthisis, dropsy, gout, or any other chronic distem-

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per, than in one of a found and healthy conftitution. For as the original difeafe is increafed by the acceffion of the venereal poifon, fo the lues is aggravated by being joined to an old diforder. The more numerous the fymptoms, and the more they affect the bones, the more difficult the cure. Of all combinations the union of fyphilis with ferofula is perhaps the moft difficult to overcome: but if the acrimony fhould feize on the nobler internal parts, fuch as the brain, the lungs, or the liver, then the difeafe becomes incurable, and the patient will either go off fuddenly in an apoplectic fit or fink under a confumption.

Cure. Viewing this difeafe as depending on a peculiar contagious matter introduced into the fyftem, and multiplied there, it is poffible to conceive that a cure may be obtained on one of three principles; either by the evacuation of the matter from the fyftem, by the deftruction of its activity, or by counteracting its influence in the fyftem. It is not impoffible that articles exift in nature capable of removing this complaint on each of thefe grounds: but we may venture at leaft to affert, that few fuch are yet difcovered. Notwithftanding numbers of pretended infallible remedies, for fyphilis, mercury is perhaps the only article on which dependence is placed among European practitioners; and with regard to its mode of operation, all the three different opinions pointed out have been adopted and fupported by different theorifts.—But although many ingenious arguments have been employed in fupport of each, we are, upon the whole, inclined to think it more probable that mercury operates by deftroying the activity of the venereal virus, than that it has effect either by evacuating it, or by exciting a ftate of action, by which its influence is counteracted. Some practitioners have affirmed, that the difeafe may be totally extirpated without the ufe of mercury: but, excepting in flight cafes, it appears from the moft accurate obfervations, that this grand fpecific is indifpenfable; whether it be introduced through the pores of the fkin, in the form of ointments, plafters, wafhes, &c.; or given by the mouth, difguifed in the different fhapes of pills troches, powders or folutions.

Formerly it was held as a rule, that a falivation ought to be raifed, and a great difcharge excited. But this is now found to be unneceffary: for as mercury probably acts by fome fpecific power in fubduing and correcting the venereal virus, all that is required is to throw in a fufficient quantity of the medicine for this purpofe; and if it can be diverted from the falivary glands fo much the better, fince the inconveniences attending a fpitting are fuch as we fhould always wifh to avoid.

Mecrury, when combined with any faline fubftance, has its activity prodigiouffy increafed; hence the great variety of chemical preparations which have been contrived to unite it with different acids.

Corrofive fublimate is one of the moft active of all the mercurial preparations, infomuch as to become a poifon even in very fmall dofes. It therefore cannot fafely be given in fubftance; but muft be diffolved in order to render it capable of a more minute divifion. We may fee, by looking into Wifeman, that this is an old medicine, though feldom given by regular practitioners. How it came to be introduced into fo remote a part of the world as Siberia, is not eafily found out; but Dr Clerc, author of the *Hiftoire Naturelle de l'Homme Malade*, affures us, that the fublimate folution has been of ufe there time out of mind.

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It appears to have been totally forgotten in other places, until of late years, when the baron Van Swieten brought it into vogue; fo that at one period, if we credit Dr Locher, they ufed no other mercurial preparation at Vienna. The number of patients cured by this remedy alone in the hofpital of St Mark, which is under the care of this gentleman, from 1754 to 1771 inclufive, being 4880.

The way to prepare the folution is, to diffolve as much fublimate in any kind of ardent fpirit (at Vienna they ufe only corn-brandy) as will give half a grain to an ounce of folution. The dofe to a grown perfon is one fpoonful mixed with a pint of any light ptifan or barley-water, and this to be taken morning and evening: the patients fhould keep moftly in a warm chamber, and lie in bed to fweat after taking the medicine: their diet fhould be light; and they ought to drink plentifully throughout the day, of whey, ptifan, or barley-water. If the folution does not keep the belly open, a mild purge muft be given from time to time; for Locher obferves, that thofe whom it purges two or three times a-day, get well fooner than thofe whom it does not purge: he alfo fays, that it very feldom affects the mouth, but that it promotes the urinary and cutaneous difcharges. This courfe is not only to be continued till all the fymptoms difappear, but for fome weeks longer. The fhorteft time in which Locher ufed to let the patients out was fix weeks; and they were continued on a courfe of decoction of the woods for fome weeks after they left off the folution.

This method has been introduced both in Britain and Ireland, though by no means to the exclufion of others; but it appears, that the folution does not turn out fo infallible a remedy, either in thefe kingdoms, or in France, as they fay it has done in Germany. It was feldom if ever found to perform a radical cure, and the frequent ufe of it proved in many cafes highly prejudicial. It has therefore been fucceeded in practice, even at Vienna, by mercury exhibited in other forms; and, among thefe, by a remedy firft recommended by Dr Plenck, and fince improved by Dr Saunders; confifting of mercury united with mucilage of gum arabic, which is faid to render its exhibition perfectly mild and fafe. For particulars, we refer to Dr Saunders's treatife.

But a late French writer, fuppofed to be Dr Petit, in a fmall book, intitled *A parallel of the different methods of treating the venereal difeafe*, infifts, that there is neither certainty nor fafety in any other method than the repeated frictions with mercurial ointment.

If therefore it is determined to have recourfe to the mercurial frictions, the patient may with advantage be prepared by going into the warm bath fome days fucceffively; having been previoufly blooded if of a plethoric habit, and taking a dofe or two of fome proper cathartic.

The patient being fitted with the neceffary apparatus of flannels, is then to enter on the courfe.

If

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If the person be of a robust habit, and in the prime of life, we may begin with two drachms of the *unguentum hydrargyri fortius*, (Ph. Lond.) which is to be rubbed in about the ankles by an assistant whose hands are covered with bladders: then having intermitted a day, we may expend two drachms more of the ointment, and rest for two days; after which, if no soreness of the mouth comes on, use only one drachm; and at every subsequent friction ascend till the ointment shall reach the trunk of the body; after which the rubbings are to be begun at the wrists, and from thence gradually extended to the shoulders. In order to prevent the mercury from laying too much hold of the mouth, it must be diverted to the skin, by keeping the patient in a constant perspiration from the warmth of the room, and by drinking plentifully of barley-water, whey, or ptisan; but if, nevertheless, the mercury should tend to raise a spitting, then, from time to time, we are either to give some gentle cathartic, or order the patient into a vapour or warm bath: and thus we are to go on, rubbing in a drachm of the ointment every second, third, or fourth night, according as it may be found to operate; and on the intermediate days either purging or bathing, unless we should choose to let the salivation come on; which, however it is much better to avoid, as we shall thus be able to throw in a larger quantity of mercury.

It is impossible to ascertain the quantity of mercury that may be necessary to be rubbed in, as this will vary according to circumstances; but we are always to continue the frictions for a fortnight at least, after all symptoms of the disease shall have totally disappeared; and when we have done with the mercury, warm bathing aud sudorific decoctions of the woods, are to be continued for some time longer.

This is a general sketch of the methods of treatment for the confirmed lues; but for a complete history of the disease, and for ample directions in every situation, we refer to Astruc, and his abridger Dr Chapman.—We have to add, however, that a method of curing this disease by fumigation has been lately recommended in France; but it seems not to meet with great encouragement. One of the most recent proposals for the cure of the venereal disease is that of Mr Clare, and consists in rubbing a small quantity of mercury under the form of *mercurius muriatus mitius*, or *calomel* as it is commonly called, on the inside of the cheek; by which means it has been supposed that we will not only avoid the inconveniences of unction, but also the purgative effects that are often produced by this medicine when taken into the stomach. But after all, the introduction of mercury under the form of unction, as recommended by the latest and best writers in Britain on the venereal disease, Dr Swediaur, Mr John Hunter, and others, is still very generally preferred in Britain to any mode that has yet been proposed.

Where, after a long trial of mercury, distressing symptoms still remain, particularly obstinate ulcerations and severe pains, benefit has often been derived from the use of opium: but there is little reason to believe, as has been held by some, that of itself it affords an infallible cure of this disease; at least we are inclined to think, that all the facts hitherto brought in support of the cure of syphilis by opium are at the utmost very doubtful. Syphilis.

In obstinate ulcerations, remaining probably after the venereal virus has been overcome, and resisting the use of mercury, a complete cure has in many instances been obtained from the use of the root of the mezereon, the daphne mezereum of Linnæus. This article has been chiefly employed under the form of decoction; and it now appears that it is the basis of an article at one time highly celebrated in venereal complaints, under the title of *Lisbon diet-drink*. But, upon the whole, these sequelæ of this disease are perhaps more readily overcome by country air, gentle exercise and nourishing diet, particularly a milk diet, than by the use of any medicine whatever. It must indeed be allowed, that for combating different sequelæ, various practices accommodated to the nature of these will on particular occasions be requisite. But into the consideration of these we cannot here propose to enter.

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Scurvy.

Scorbutus, *Sauv.* gen. 391. *Lin.* 223. *Vog.* 318. *Sag.* 127. *Boerh.* 1148. *Hoffm.* III. 369. *Junck.* 91. *Lind* on the Scurvy. *Hulme* de Scorbuto. *Rouppe* de morbis Navigantium.

Description. The first indication of the scorbutic diathesis is generally a change of colour in the face, from the natural and healthy look to a pale and bloated complexion, with a listlessness, and aversion from every sort of exercise; the gums soon after become itchy, swell, and are apt to bleed on the slightest touch; the breath grows offensive; and the gums, swelling daily more and more, turn livid, and at length become extremely fungous and putrid, as being continually in contact with the external air; which in every case favours the putrefaction of substances disposed to run into that state, and indeed is absolutely requisite for the production of actual rottenness.

The symptoms of the scurvy, like those of every other disease, are somewhat different in different subjects, according to the various circumstances of constitution; and they do not always proceed in the same regular course in every patient. But what is very remarkable in this disease, notwithstanding the various and immense load of distress under which the patients labour, there is no sickness at the stomach, the appetite keeps up, and the senses remain entire almost to the very last: when lying at rest, they make no complaints, and feel little distress or pain; but the moment they attempt to rise or stir themselves, then the breathing becomes difficult, with a kind of straitness or catching, and great oppression, and sometimes they have been known to fall into a syncope. This catching of the breath upon motion, with the loss of strength, dejection of spirit, and rotten gums, are held as the essential or distinguishing symptoms of the disease. The skin is generally dry, except in the very last stage, when the patients become exceedingly subject to faintings, and then it grows clammy and moist: in some it has an anserine appearance; but much oftener it is smooth and shining; and, when examined, is found to be spread over with spots not rising above the surface, of a reddish, bluish, livid, or purple colour, with

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a sort of yellow rim round them. At first these spots are for the most part small, but in time they increase to large blotches. The legs and thighs are the places where they are principally seen: more rarely on the head and face. Many have a swelling of the legs, which is harder, and retains the impression of the finger longer than the common dropsical or truly œdematous swellings. The slightest wounds and bruises, in scorbutic habits, degenerate into foul and untoward ulcers. And the appearance of these ulcers is so singular and uniform, that they are easily distinguished from all others. Scorbutic ulcers afford no good digestion, but give out a thin and fetid ichor mixed with blood, which at length has the appearance of coagulated gore lying caked on the surface of the sore, not to be separated or wiped off without some difficulty. The flesh underneath these sloughs feels to the probe soft and spongy, and is very putrid. Neither detergents nor escharotics are here of any service; for though such sloughs be with great pains taken away, they are found again at the next dressing, where the same sanguineous putrid appearance always presents itself. Their edges are generally of a livid colour, and puffed up with excrescences of proud flesh arising from below the skin. As the violence of the disease increases, the ulcers shoot out a soft bloody fungus, which often rises in a night's time to a monstrous size; and although destroyed by cauteries, actual or potential, or cut away with the knife, is found at next dressing as large as ever. It is a considerable time, however, before these ulcers, bad as they are, come to affect the bones with rottenness—These appearances will always serve to assure us that an ulcer is scorbutic; and should put us on our guard with respect to the giving mercurials, which are the most pernicious things that can be administered in these cases.

Scorbutic people, as the disease advances are seldom free from pains; though they have not the same seat in all, and often in the same person shift their place. Some complain of universal pain in all their bones; but most violent in the limbs, and especially the joints: the most frequent seat of their pain, however, is some part of the breast. The pains of this disease seem to arise from the distraction of the sensible fibres by the extravasated blood being forced into the interstices of the periosteum and of the tendinous and ligamentous parts; whose texture being so firm, the fibres are liable to higher degrees of tension, and consequently of pain.

The states of the bowels are various: in some there is an obstinate costiveness; in others a tendency to a flux, with extremely fetid stools: the urine is also rank and fetid, generally high-coloured; and, when it has stood for some hours, throws up an oily scum on the surface. The pulse is variable; but most commonly slower and more feeble than in the time of perfect health. A stiffness in the tendons, and weakness in the joints of the knees, appear early in the disease: but as it grows more inveterate, the patients generally lose the use of their limbs altogether; having a contraction of the flexor-tendons in the ham, with a swelling and pain in the joint of the knee. Some have their legs monstrously swelled, and covered over with livid spots or ecchymoses; others have had tumors there; some, though without swelling, have the calves of the legs and the flesh of the thighs quite indurated. As persons far gone in the scurvy are apt to faint, and even expire, on being moved and brought out into the fresh air, the utmost care and circumspection are requisite when it is necessary to stir or remove them.

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Scorbutic patients are at all times, but more especially as the disease advances, extremely subject to profuse bleedings from different parts of the body; as from the nose, gums, intestines, lungs, &c. and likewise from their ulcers, which generally bleed plentifully if the fungus be cut away. It is not easy to conceive a more dismal and diversified scene of misery than what is beheld in the third and last stage of this distemper; it being then that the anomalous and more extraordinary symptoms appear, such as the bursting out of old wounds, and the dissolution of old fractures that have been long united.

Causes. The term *scurvy* has been indiscriminately applied, even by physicians, to almost all the different kinds of cutaneous foulness; owing to some writers of the last century, who comprehended such a variety of symptoms under this denomination, that there are few chronic distempers which may not be so called, according to their scheme: but the disease here meant is the true putrid scurvy, so often fatal to seamen, and to people pent up in garrisons without sufficient supplies of sound animal-food and fresh vegetables; or which is sometimes known to be endemic in certain countries, where the nature of the soil, the general state of the atmosphere, and the common course of diet, all combine in producing that singular species of corruption in the mass of blood which constitutes this disease; for the appearances, on dissecting scorbutic subjects, sufficiently show that the scurvy may, with great propriety, be termed a disease of the blood.

Dr Lind has, in a postscript to the third edition of his treatise on the scurvy, given the result of his observations drawn from the dissection of a considerable number of victims to this fatal malady, from which it appears that the true scorbutic state, in an advanced stage of the distemper, consists in numerous effusions of blood into the cellular interstices of most parts of the body, superficial as well as internal; particularly the gums and the legs; the texture of the former being almost entirely cellular, and the generally dependent state of the latter rendering these parts, of all others in the whole body, the most apt to receive, and retain the stagnant blood, when its crasis comes to be destroyed; and it loses that glutinous quality which, during health, hinders it from escaping thro' the pores in the coats of the blood-vessels or through exhalant extremities.

A dropsical indisposition, especially in the legs and breast, was frequently, but not always, observed in the subjects that were opened, and the pericardium was sometimes found distended with water: the water thus collected was often so sharp as to shrivel the hands of the dissector; and in some instances, where the skin happened to be broken, it irritated and festered the wound.

The fleshy fibres were found so extremely lax and tender, and the bellies of the muscles in the legs and thighs so stuffed with the effused stagnating blood, that it was always difficult, and sometimes impossible, to

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to raise or separate one muscle from another. He says that the quantity of this effused blood was amazing; in some bodies it seemed that almost a fourth part of the whole mass had escaped from the vessels; and it often lay in large concretions on the periosteum, and in some few instances under this membrane immediately on the bone. And yet, notwithstanding this dissolved and depraved state of the external fleshy parts, the brain always appeared perfectly sound, and the viscera of the abdomen, as well as those in the thorax, were in general found quite uncorrupted. There were spots indeed, from extravasated blood, observed on the mesentery, intestines, stomach, and omentum; but these spots were firm, and free from any mortified taint; and, more than once, an effusion of blood as large as a hand's breadth, has been seen on the surface of the stomach; and what was remarkable, that very subject was not known while living to have made any complaint of sickness, pain, or other disorder, in either stomach or bowels.

These circumstances and appearances, with many others that are not here enumerated, all prove to a demonstration a putrescent, or at least a highly depraved state of the blood: and yet Dr Lind takes no small pains to combat the idea of the scurvy's proceeding from animal putrefaction; a notion which, according to him, "may, and hath misled physicians to propose and administer remedies for it altogether ineffectual."

He also, in the preface to his third edition, talks of the mischief done by an attachment to delusive theories. He says, "it is not probable that a remedy for the scurvy will ever be discovered from a preconceived hypothesis, or by speculative men in the closet, who have never seen the disease, or who have seen at most only a few cases of it;" and adds, "that though a few partial facts and observations may, for a little, flatter with hopes of greater success, yet more enlarged experience must ever evince the fallacy of all positive assertions in the healing art."

Sir John Pringle, however, is of a very different opinion. He "is persuaded, after long reflection, and the opportunities he has had of conversing with those who to much sagacity had joined no small experience in nautical practice, that upon an examination of the several articles which have either been of old approved, or have of late been introduced into the navy, it will appear, that though these means may vary in form and in mode of operating, yet they all some way contribute towards preventing putrefaction; whether of the air in the closer parts of a ship, of the meats, of the water, of the clothes and bedding, or of the body itself.

What Dr Lind has above advanced is the more remarkable, as, in the two former editions of his book, he embraced the hypothesis of animal-putrefaction being the cause of the scurvy; and if these effusions of blood, from a destruction of its crasis and the dissolved state of the muscular fibres, together with the rotten condition of the mouth and gums do not betray putrescency, it is hard to say what does, or what other name we shall bestow on this peculiar species of depravation which constitutes the scurvy.

The blood, no doubt, derives its healthy properties, and maintains them, from the due supplies of wholesome food; while the insoluble, superfluous, effete, and acrid parts, are carried off by the several discharges of stool, urine, and perspiration.

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Our senses of taste and smell are sufficient to inform us when our food is in a state of soundness and sweetness, and consequently wholesome; but it is from chemistry that we must learn the principles on which these qualities chiefly depend.

Experiments of various kinds have proved, that the soundness of animal and vegetable substances depends very much, if not entirely, on the presence of their aerial principle; since rottenness is never observed to take place without an emission of fixed air from the putrefying substance; and even when putrefaction has made a considerable progress, if aerial acid can be transferred, in sufficient quantity, from some other substance in a state of effervescence or fermentation, into the putrid body, the offensive smell of this will be destroyed; and if it be a bit of rotten flesh with which the experiment is made, the firmness of its fibres will be found in some measure restored.

The experiments of Dr Hales, as well as many others made since his time, show that an aerial principle is greatly connected with, and remarkably abundant in, the gelatinous parts of animal bodies, and in the mucilage or farina of vegetables. But these are the parts of our food which are most particularly nutritive; and Dr Cullen, whose opinion on this as on every other medical subject must be allowed of the greatest weight, affirms, in his Lectures on the Materia Medica, that the substances on which we feed are nutritious only in proportion to the quantities of oil and sugar which they respectively contain. This oil and sugar are blended together in the gelatinous part of our animal-food, and in the mucilaginous and farinaceous part of esculent vegetables; and, while thus intimately combined are not perceivable by our taste, though very capable of being developed and rendered distinct by the power of the digestive organs; for in consequence of the changes produced during digestion, the oily and the saccharine matter become manifest to our senses, as we may see and taste in the milk of animals, which is chiefly chyle a little advanced in its progress toward sanguification; the oil is observed to separate spontaneously, and from which a quantity of actual sugar may be obtained by a very simple process.

Thus much being premised, we can now readily comprehend how the blood may come to lose those qualities of smoothness, mildness, and tenacity, which are natural to it. For if, in the first place, the fluids, and organs subservient to digestion should be so far distempered or debilitated that the nutritious parts of the food, cannot be properly developed, the blood must be defrauded of its due supplies; which will also be the case if the aliment should not originally contain enough of oily and saccharine matter, or should be so circumstanced, from being dried or salted, as to hinder the ready extrication of the nutritious parts; or lastly, if the natural discharges should be interrupted or suspended, so that the superfluous, acrid, and effete fluids are retained in the general mass; in all these instances the blood must of necessity run into proportionate degrees of depravation.

And hence we may understand how it may possibly happen,

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happen, that when persons are greatly weakened by some preceding disorder, and at the same time debarred the use of proper bodily exercise, the scorbutic diathesis should take place, even though they enjoy the advantages of pure air and wholesome diet. But these are solitary cases, and very rarely seen; for whenever the scurvy seizes numbers, and can be considered as an epidemic disease, it will be found to depend on a combination of the major part, or perhaps all, of the following circumstances:

1. A moist atmosphere, and more especially if cold be joined to this moisture. 2. Too long cessation from bodily exercise, whether it be from constraint, or a lazy slothful disposition. 3. Dejection of mind. 4. Neglect of cleanliness, and want of sufficient clothing. 5. Want of wholesome drink, either of pure water or fermented liquors. And, 6. Above all, the being obliged to live continually on salted meats, perhaps not well cured, without a due proportion of the vegetables sufficient to correct the pernicious tendency of the salt, by supplying the bland oil and saccharine matter requisite for the purposes of nutrition.

These general principles respecting the causes and nature of scurvy, seem to afford a better explanation of the phenomena of the disease than any conjectures respecting it that have hitherto been proposed. It must, however, be allowed, that Dr Lind is by no means the only writer who is disposed to consider this disease as not referable to the condition of the circulating fluids. In a late ingenious treatise on this subject by Dr Milman, he strenuously contends, that the primary morbid affection in this complaint is a debilitated state of the solids arising principally from want of aliment. But his arguments on this subject, as well as those of Dr Lind, are very ably answered by a still later writer on this subject, Dr Trotter, who has drawn his observations respecting it from very extensive experience, and who considers it as clearly established, by incontrovertible facts that the proximate cause of scurvy depends on some peculiar state of the blood.—Dr Trotter, in the second edition of his Observations on the Scurvy, from the result of farther observation and later discoveries in chemistry, has attempted, with much ingenuity, to prove that the morbid condition of the blood, which takes place in scurvy, arises from the abstraction of vital air, or, as it is now generally called, *oxygene*; and this opinion, though still, perhaps, in some particulars requiring farther confirmation, is, it must be allowed, supported by many plausible arguments.

Prevention and Cure. The scurvy may be prevented, by obviating and correcting those circumstances in respect of the non-naturals which were mentioned as contributing to the disease, and laid down as causes. It is therefore a duty highly incumbent on officers commanding at sea, or in garrisons, to use every possible precaution; and, in the first place, to correct the coldness and moisture of the atmosphere by sufficient fires: in the next, to see that their men be lodged in dry, clean, and well ventilated births or apartments: thirdly, to promote cheerfulness, and enjoin frequent exercise, which alone is of infinite use in preventing the scurvy: fourthly, to take care that the cloathing be proper, and cleanliness of person strictly observed: fifthly, to supply them with wholesome drink, either pure water or sound fermented liquors; and if spirits be allowed, to have them properly diluted with water and sweetened with melasses or coarse sugar: and lastly, to order the salted meats to be sparingly used, or sometimes entirely abstained from; and in their place, let the people live on different compositions of the dried vegetables; fresh meat and recent vegetables being introduced as often as they can possibly be procured.

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A close attention to these matters will, in general, prevent the scurvy from making its appearance at all, and will always hinder it from spreading its influence far. But when these precautions have been neglected, or the circumstances such that they cannot be put in practice, and the disease hath actually taken place, our whole endeavour must be to restore the blood to its original state of soundness: and happily, such is the nature of this disease, that if a sufficiency of new matter, of the truly mild nutritious sort, and particularly such as abounds with vital air, such as recent vegetables, or different acid fruits, can be thrown into the circulation while the fleshy fibres retain any tolerable degree of firmness, the patient will recover; and that in a surprisingly short space of time, provided a pure air, comfortable lodgings, sufficient cloathing, cleanliness, and exercise lend, their necessary aid.

This being the case, the plan of treatment is to be conducted almost entirely in the dietetic way; as the change in the mass of blood, which it is necessary to produce, must be brought about by things that can be received into the stomach by pints or pounds, and not by those which are administred in drops or grains, drachms or ounces. For here, as there is no disorder of the nervous system, we have no need of those active drugs which are indispensably necessary in febrile or nervous diseases; the scorbutic diathesis being quite opposite to that which tends to produce a fever or any species of spasmodic disorders; nay, Dr Lind says, he has repeatedly found, that even the infection of an hospital fever is long resisted by a scorbutic habit.

It will now naturally occur to the reader, what those alimentary substances must be which bid the fairest to restore the blood to its healthy state; and he needs scarcely to be told, that they are of those kinds which the stomach can bear with pleasure though taken in large quantities, which abound in jelly or mucilage, and which allow those nutritious parts to be easily developed; for though the viscera in scorbutic patients may be all perfectly sound, yet we cannot expect that either the digestive fluids or organs should possess the same degrees of power, which enable them, during health, to convert the crude dry farinacea, and the hard salted flesh of animals, into nourishment. We must therefore search for the *antiscorbutic virtue* in the tender sweet flesh of herbivorous animals; in new milk; and in the mucilaginous acid juices of recent vegetables, whether they be fruits, leaves, or roots.

The sour juices of lemons, oranges, and limes, have been generally held as antiscorbutics in an eminent degree, and their power ascribed to their acid; from an idea that acids of all kinds are the only correctors of putrefaction. But the general current of practical observations

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obſervations ſhows, and our experiments confirm it, that the virtue of theſe juices depends on their *aerial principle*; accordingly, while perfectly recent and in the mucilaginous ſtate, and eſpecially if mixed with wine and ſugar, the juices of any one of theſe fruits will be found a moſt grateful and powerful antiſcorbutic.

Dr Lind obſerving, "that the lemon-juice, when given by itſelf undiluted, was apt, eſpecially if overdoſed, to have too violent an operation, by occaſioning pain and ſickneſs at the ſtomach, and ſometimes a vomiting; therefore found it neceſſary to add wine and ſugar. A pint of Madeira wine, and two ounces of ſugar, were put to four ounces and a half of juice, and this quantity was found ſufficient for weak patients to uſe in 24 hours: ſuch as were very weak ſipped a little of this frequently according as their ſtrength would permit; others who were ſtronger took about two ounces of it every two hours; and when the patients grew ſtill ſtronger, they were allowed eight ounces of lemon-juice in 24 hours."

While this very pleaſant mixture, which is both a cordial and an antiſeptic, may be had, it would be needleſs to think of preſcribing any other; but when the freſh juice cannot be procured, we muſt have recourſe to ſuch other things as may be obtained. But the various modes of combining and adminiſtering theſe, ſo as to render them perfectly agreeable to the ſtomach, muſt always be regulated by circumſtances, and therefore it will be in vain to lay down particular directions; ſince all that we have to do is, to fix on ſuch fruits and other freſh vegetables as can be moſt conveniently had and taken, and contrive to give them in thoſe forms, either alone or boiled up with fleſh-meat into ſoups, that will allow the patients to conſume the greateſt quantities.

The firſt promiſing alteration from ſuch a courſe is uſually a gentle diarrhœa; and if, in a few days, the ſkin becomes ſoft and moiſt, it is an infallible ſign of recovery; eſpecially if the patient gain ſtrength, and can bear being ſtirred or carried into the open air without fainting.

But if the belly ſhould not be looſened by the uſe of the freſh vegetables, nor the ſkin become ſoft and moiſt, then they muſt be aſſiſted by ſtewed prunes, or a decoction of tamarinds with cream of tartar, in order to abate the coſtiveneſs; and by drinking a light decoction of the woods, and warm bathing, in order to relax the pores of the ſkin; for nothing contributes more to the recovery of ſcorbutic patients than moderate ſweating.

With regard to particular ſymptoms, antiſeptic mouth-waters compoſed of a decoction of the Peruvian bark and infuſion of roſes, with a ſolution of myrrh, muſt be uſed occaſionally, in order to cleanſe the mouth, and give firmneſs to the ſpongy gums. Swelled and indurated limbs, and ſtiffened joints, muſt be bathed with warm vinegar, and relaxed by the ſteam of warm water, repeatedly conveyed to them, and confined to the parts by means of cloſe blankets: ulcers on the legs muſt never be treated with unctuous applications nor ſharp eſcharotics; but the dreſſing ſhould conſiſt of lint or ſoft rags, dipt in a ſtrong decoction of Peruvian bark.

This diſeaſe at no time requires, or indeed bears, large evacuations, either by bleeding or purging; and, as has been already mentioned, the belly muſt only be kept open by the freſh vegetables or the mildeſt laxatives. But we are always to be careful that ſcorbutic perſons, after a long abſtinence from greens and fruits, be not permitted to eat voraciouſly at firſt, leſt they fall into a fatal dyſentery.

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All, however, that has now been laid down as neceſſary towards the cure, ſuppoſes the patients to be in ſituations where they can be plentifully furniſhed with all the requiſites; but unhappily theſe things are not to be procured at ſea, and often deficient in garriſons: therefore, in order that a remedy for the ſcurvy might never be wanting, Dr Macbride, in the year 1762, firſt conceived the notion, that the *infuſion of malt*, commonly called *wort*, might be ſubſtituted for the common antiſcorbutics; and it was accordingly tried.

More than three years elapſed before any account arrived of the experiments having been made; at length ten hiſtories of caſes were received, wherein the wort had been tried, with very remarkable ſucceſs; and this being judged a matter of great importance to the ſeafaring part of mankind, theſe were immediately communicated to the public in a pamphlet under the title of *An hiſtorical account of a new method of treating the ſcurvy at ſea.*

This was in 1767; but after that time a conſiderable number of letters and medical journals, ſufficient to make up a ſmall volume, were tranſmitted to the author, particularly by the ſurgeons of his Britannic Majeſty's ſhips who had been employed of late years for making diſcoveries in the ſouthern hemiſphere. Certain it is, that in many inſtances it has ſucceeded beyond expectation. In others it has fallen ſhort: but whether this was owing to the untoward ſituation of the patients, or inattention on the part of the perſons who were charged with the adminiſtration of the wort, not preparing it properly, or not giving it in ſufficient quantity, or to its own want of power, muſt be collected from the caſes and journals themſelves.

During Captain Cook's third voyage, the moſt remarkable, in reſpect of the healthineſs of the crew, that ever was performed, the wort is acknowledged to have been of ſingular uſe.

In a letter which this very celebrated and ſucceſsful circumnavigator wrote to Sir John Pringle, he gives an account of the methods purſued for preſerving the health of his people; and which were productive of ſuch happy effects, that he performed "a voyage of three years and 18 days, through all the climates from 52° north to 71° ſouth, with the loſs of one man only by diſeaſe, and who died of a complicated and lingering illneſs, without any mixture of ſcurvy. Two others were unfortunately drowned, and one killed by a fall; ſo that out of the whole number 118 with which he ſet out from England, he loſt only four.

He ſays, that much was owing to the extraordinary attention of the admiralty, in cauſing ſuch articles to be put on board as either by experience of conjecture were judged to tend moſt to preſerve the health of ſeamen; and with reſpect to the wort, he expreſſes himſelf as follows:

"We had on board a large quantity of *malt*, of which

Impetigines which was made *sweet wort*, and given (not only to those men who had manifest symptoms of the scurvy, but to such also as were, from circumstances, judged to be most liable to that disorder) from one or two to three pints in the day to each man, or in such proportion as the surgeon thought necessary, which sometimes amounted to three quarts in the 24 hours: this is without doubt one of the best antiscorbutic sea-medicines yet found out; and if given in time, will, with proper attention to other things, I am persuaded, prevent the scurvy from making any great progress for a considerable time: but I am not altogether of opinion that it will cure it, in an advanced state, at sea."

On this last point, however, the Captain and his Surgeon differ; for this gentleman positively asserts, and his journal (in Dr Macbride's possession) confirms it, that the infusion of malt did effect a cure in a confirmed case, and at sea.

The malt, being thoroughly dried, and packed up in small casks, is carried to sea, where it will keep sound, in every variety of climate, for at least two years: when wanted for use, it is to be ground in a hand-mill, and the infusion prepared from day to day, by pouring three measures of boiling water on one of the ground malt; the mixture being well mashed, is left to infuse for 10 or 12 hours, and the clear infusion then strained off. The patients are to drink it in such quantities as may be deemed necessary, from one to three quarts in the course of the 24 hours: a panado is also to be made of it, by adding biscuit, and currants or raisins; and this palatable mess is used by way of solid food. This course of diet, like that of the recent vegetables, generally keeps the bowels sufficiently open; but in cases where costiveness nevertheless prevails, gentle laxatives must be interposed from time to time, together with diaphoretics, and the topical assistants, fomentations and gargles, as in the common way of management.

Captain Cook was also provided with a large stock of *sour krout;* (cabbage-leaves cut small, fermented and stopped in the second stage of fermentation.) A pound of this was served to each man, twice a-week, while they were at sea. Sour krout, since the trial made of it on board Captain Cook's ships, has been extensively used by direction of the British government in many other situations, where scorbutus has prevailed; and it has been found to be highly serviceable both in preventing and in curing the disease. It was particularly found during the late American war to be highly beneficial to the British troops besieged in Boston, who were at that time entirely fed on salt provisions sent from England. The scurvy at one period broke out among them with very alarming appearances; but by the seasonable arrival of a quantity of sour krout, it was effectually overcome. Care, however, must be bestowed, that this article be properly prepared and properly kept. When due attention is paid to these particulars, it may be preserved in good condition for many months; and is considered both by sailors and soldiers as a very acceptable addition to their salt provisions. But when served out to them in a putrid state, it is not only highly disagreeable to the taste, but probably also pernicious in its effects.

Among other means of preventing scurvy, Captain Cook had also a liberal supply of *portable soup*; of which the men had generally an ounce, three days in the week, boiled up with their pease; and sometimes it was served to them oftener; and when they could get fresh greens, it was boiled up with them, and made such an agreeable mess, that it was the means of making the people eat a greater quantity of greens than they would otherwise have done. And what was still of further advantage, they were furnished with sugar in lieu of butter or oil, which is seldom of the sweetest sort; so that the crew were undoubtedly great gainers by the exchange.

In addition to all these advantages of being so well provided with every necessary, either in the way of diet or medicine, Captain Cook was remarkably attentive to all the circumstances respecting cleanliness, exercise, sufficient cloathing, provision of pure water, and purification of the air in the closer parts of the ship.

From the effect of these different means, as employed by Captain Cook, there can be little doubt that they will with due attention be sufficient for the prevention and cure of the disease, at least in most situations: but besides these, there are also some other articles which may be employed with great advantage.

Newly brewed spruce-beer made from a decoction of the tops of the spruce-fir and melasses, is an excellent antiscorbutic: it acts in the same way that the wort does, and will be found of equal efficacy, and therefore may be substituted. Where the tops of the spruce-fir are not to be had, this beer may be prepared from the essence of spruce as it has been called, an article which keeps easily for a great length of time. But in situations where neither the one nor the other can be had, a most salutary mess may be prepared from oatmeal, by infusing it in water, in a wooden vessel, till it ferments, and begins to turn sourish; which generally happens, in moderately warm weather, in the space of two days.—The liquor is then strained off from the grounds, and boiled down to the consistence of a jelly, which is to be eat with wine and sugar, or with butter and sugar.

Nothing is more commonly talked of than a *land-scurvy*, as a distinct species of disease from that which has been now described; but no writer has yet given a description so clear as to enable us to distinguish it from the various kinds of cutaneous foulness and eruption, which indeed are vulgarly termed *scorbutic*, but which are a-kin to the itch or leprosy, and for the most part require mercurials. These, however, are very different diseases from the true scorbutus, which, it is well known, may prevail in certain situations on land as well as at sea, and is in no degree to be attributed to sea air.

Genus LXXXVII. ELEPHANTIASIS. 352

Elephantiasis, *Sauv.* gen. 302. *Vog.* 321. *Sag.* gen. 128.

Elephantia Arabum, *Vog.* 322.

The best account of this disease is that by Dr Heberden, published in the first volume of the Medical Transactions. According to him, frequently the first symptom is a sudden eruption of tubercles, or bumps of different sizes, of a red colour, more or less intense (attended

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(attended with great heat and itching), on the body, legs, arms, and face; ſometimes in the face and neck alone, at other times occupying the limbs only; the patient is feveriſh; the fever ceaſing, the tubercles remain indolent, and in ſome degree ſcirrhous, of a livid or copper colour, but ſometimes of the natural colour of the ſkin, or at leaſt very little altered; and ſometimes they after ſome months ulcerate, diſcharging a fetid ichorus humor in ſmall quantity, but never laudable pus.

The features of the face ſwell and enlarge greatly; the part above the eye-brows ſeems inflated; the hair of the eye-brows falls off, as does the hair of the beard; but Dr Heberden has never ſeen any one whoſe hair has not remained on his head. The *alæ naſi* are ſwelled and ſcabrous; the noſtrils patulous, and ſometimes affected with ulcers, which, corroding the cartilage and *ſeptum naſi*, occaſion the noſe to fall off. The lips are tumid; the voice is hoarſe; which ſymptom has been obſerved when no ulcers have appeared in the throat, although ſometimes both the throat and gums are ulcerated. The ears, particularly the lobes, are thickened, and occupied by tubercles. The nails grow ſcabrous and rugoſe, appearing ſomething like the rough bark of a tree; and the diſtemper advancing, corrodes the parts gradually with a dry ſordid ſcab or gangrenous ulcer; ſo that the fingers and toes rot and ſeparate joint after joint. In ſome patients the legs ſeem rather poſts than legs, being no longer of the natural ſhape, but ſwelled to an enormous ſize, and indurated, not yielding to the preſſure of the fingers; and the ſuperficies is covered with very thin ſcales, of a dull whitiſh colour, ſeemingly much finer, but not ſo white as thoſe obſerved in the *lepra Græcorum*. The whole limb is overſpread with tubercles, interſperſed with deep fiſſures; ſometimes the limb is covered with a thick moiſt ſcabby cruſt, and not unfrequently the tubercles ulcerate. In others the legs are emaciated, and ſometimes ulcerated; at other times affected with tubercles without ulceration. The muſcular fleſh between the thumb and fore-finger is generally extenuated.

The whole ſkin, particularly that of the face, has a remarkably ſhining appearance, as if it was varniſhed or finely poliſhed. The ſenſation in the parts affected is very obtuſe, or totally aboliſhed; ſo that pinching, or puncturing the part, gives little or no uneaſineſs; and in ſome patients, the motion of the fingers and toes is quite deſtroyed. The breath is very offenſive; the pulſe in general weak and ſlow.

The diſeaſe often attacks the patient in a different manner from that above deſcribed beginning almoſt inſenſibly; a few indolent tubercles appearing on various parts of the body or limbs, generally on the legs or arms, ſometimes on the face, neck, or breaſt, and ſometimes in the lobes of the ears, increaſing by very ſlow degrees, without any diſorder, previous or concomitant, in reſpect of pain or uneaſineſs.

To diſtinguiſh the diſtemper from its manner of attacking the patient. Dr Heberden ſtyles the firſt by *fluxion* and the other by *congeſtion*. That by fluxion is often the attendant of a crapula, or ſurfeit from groſs foods; whereby, perhaps, the latent ſeeds of the diſorder yet dormant in the maſs of blood are excited: and probably from frequent obſervations of this kind (the laſt meal always having the blame laid on it), it is, that, according to the received opinion, either fiſh, (the tunny, mackarel, and ſhell-fiſh, in particular), melons, cucumbers, young garden-beans, or mulberries, eaten at the ſame meal with butter, cheeſe, or any preparation with milk, are ſuppoſed to produce the diſtemper, and are accordingly religiouſly avoided.

Elephantiaſis.

Violent commotions of the mind, as anger, fear, and grief, have more than once been obſerved to have given riſe to the diſorder; and more frequently, in the female ſex, a ſudden ſuppreſſion of an accuſtomed evacuation, by bathing the legs and feet in cold water at an improper ſeaſon,

The diſorder by fluxion is what is the oſteneſt endeavoured to be remedied by timely application; that by congeſtion, not being ſo conſpicuous, is generally either neglected or attempted to be concealed, untill perhaps it be too late to be cured, at leaſt unleſs the patients would ſubmit to a longer courſe of medicine and ſtricter regimen of diet than they are commonly inclined to do.

Several incipient diſorders by fluxion have been known to yield to an antiphlogiſtic method, as bleeding, refrigerant ſalts, in the ſaline draughts, and a ſolution of cryſtals of tartar in water, for common drink, (by this means endeavouring to precipitate part of the peccant matter, perhaps too groſs to paſs the pores by the kidneys); and when once the fever is overcome, the Peruvian bark combined with ſaſſafras is the remedy principally to be relied on. The only topical medicine preſcribed by Dr Heberden, was an attenuating embrocation of brandy and alkaline ſpirit. By the ſame method ſome confirmed caſes have been palliated. But, excepting in one patient he never ſaw or heard of a confirmed elephantiaſis radically cured. He adds however, that he never met with another patient poſſeſſed with prudence and perſeverance enough to proſecute the cure as he ought.

Genus LXXXVIII. LEPRA. 353
The Leprosy.

Lepra, *Sauv.* gen. 303. *Lin.* 262. *Sag.* 129.
Lepra *Græcorum*. *Vog.* 320.

This diſtemper is but little known to phyſicians in the weſtern parts of Europe. Wallis tells us, that it firſt begins with red pimples, or puſtules, breaking out in various parts of the body. Sometimes they appear ſingle; ſometimes a great number ariſe together; eſpecially on the arms and legs: as the diſeaſe increaſes, freſh pimples appear, which, joining the former, make a ſort of cluſters; all which enlarge their borders, and ſpread in an orbicular form. The ſuperficies of theſe puſtules are rough, whitiſh, and ſcaly; when they are ſcratched the ſcales fall off, upon which a thin ichor oozes out, which ſoon dries and hardens into a ſcaly cruſt. Theſe cluſters of puſtules are at firſt ſmall and few; perhaps only three or four in an arm or leg, and of the ſize of a ſilver penny. But if the diſeaſe be ſuffered to increaſe, they become more numerous, and the cluſters increaſe to the ſize of a crown-piece, but not exactly round. Afterwards it increaſes to ſuch a degree, that the whole body is covered with a leprous ſcurf. The cure of this diſtemper is very much the ſame

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same with that of the ELEPHANTIASIS. Here, however, recourse is frequently had to antimonial and mercurial medicines, continued for a considerable length of time. In conjunction with these, warm bathing, particularly the vapour bath, has often been employed with advantage.

Although what can strictly be called lepra is now at least, a very rare disease in this country, yet to this general head may be referred a variety of cutaneous affections which are there very common, and which in many instances prove very obstinate. These appear under a variety of different forms; sometimes under that of red pustules; sometimes of white scurfs; sometimes of ulcerations; and not unfrequently a transition takes place from one form to another, so that they cannot be divided into different genera from the external appearance. These affections will often yield to the remedies already mentioned; but where antimonials and mercurials either fail, or from different circumstances are considered as unadvisable, a cure may sometimes be effected by others. In particular cases, purging mineral waters, the decoction of elm bark, the infusion of the œnanthe crocata, and various others, have been employed with success. Different external applications also have sometimes been employed with advantage. An article used in this way, known under the name of Gowland's lotion, with the composition of which we are unacquainted, has been much celebrated, and has been said to be used with great success, particularly against eruptions on the face and nose.

354 GENUS LXXXIX. FRAMBOESIA.
The YAWS.

Frambœsia, *Sauv.* gen. 125. *Sag.* 125.

Description. The description which is given of this distemper by the anonymous author of a paper in the sixth volume of the Edinburgh Medical Essays (art. 76.) differs, in some circumstances, from one that Sauvages received from M. Virgile, an eminent surgeon of Montpelier, who practised 12 years in the island of St Domingo; and therefore he distinguishes the *frambœsia* into two species, *Guineensis* and *Americana*.

The *frambœsia Guineensis* is said by the first mentioned writer to be so common on the coast of Guinea and other parts of Africa, that it seldom fails to attack each individual of both sexes, one time or other in the course of their lives; but most commonly during childhood or youth. "It makes its apppearance in little spots on the cuticle, level with the skin, at first no larger than a pin's head which increase daily, and become protuberant like pimples: soon after the cuticle frets off, and then, instead of finding pus or ichor, in this small tumor, only white sloughs or sordes appear, under which is a small red fungus growing out of the cutis, increasing gradually to very different magnitudes, some less than the smallest wood strawberry, some as big as a raspberry, and others exceeding in size even the largest mulberries; which berries they very much resemble, being knobbed as they are." These protuberances, which gave the name to the disease, appear on all parts of the body; but the greatest numbers, and the largest sized, are generally found in the groins, and about the pudenda or anus, in the arm-pits, and on the face; when the yaws are very large, they are few in number; and when remarkably numerous, they are less in size. The patients, in all other respects, enjoy good health, do not lose their appetite, and seem to have little other uneasiness than what the sores occasion. Frambœsia.

M. Virgile describes the species of yaws that is common among the negroes of St Domingo, and which Sauvages has termed *frambœsia Americana*, as beginning from an ulcer that breaks out indiscriminately in different parts of the body, though most commonly on the legs; at first superficial, and not different from a common ulcer in any other circumstances save its not healing by the usual applications; sooner or later, numerous fungous excrescences break out on the surface of the body, as before described, like little berries moist, with a reddish mucus. Besides these, the soles of the feet and palms of the hands became raw, the skin fretting off, so as to leave the muscles bare; these excoriations are sometimes moist with ichor and sometimes dry, but always painful and consequently very distressing. They are mentioned also by the author of the article in the Medical Essays; and both he and M. Virgile observe, that there is always one excrescence, or yaw, of an uncommon size, which is longer in falling off than the others, and which is considered as the *master-yaw*, and so termed. An ingenious inaugural dissertation on the subject of the yaws was lately published at Edindurgh by Dr Jonathan Anderson Ludford, now physician in Jamaica. The author of that dissertation considers Dr Cullen as improperly referring frambœsia to the class of cachexiæ. He thinks that this disease ought rather to be referred to the exanthemata; for, like the small-pox, he tells us it has its accession, height, and decline. It begins with some degree of fever, either more or less violent it may be propagated by inoculation; and it attacks the same individual only once in the course of a lifetime, those who once recover from the disease being never afterwards affected with it. These particulars respecting frambœsia are rested not merely on the authority of Dr Ludford, but are supported also by the testimony of Dr William Wright, a physician of distinguished eminence, who, while he resided in Jamaica had, in the course of extensive practice, many opportunities of observing this disease, and to whom Dr Ludford acknowledges great obligations for having communicated to him many important facts respecting it.

Dr Ludford considers the yaws as being in every instance the consequence of contagion, and as depending on a matter *sui generis*. He considers no peculiar predisposition from diet, colours, or other circumstances, as being in any degree necessary. He views the disease as chiefly arising from contact with the matter, in consequence of sleeping in the same bed, washing in the same vessel with the infected, or the like. In short, the yaws may be communicated by any kind of contact; nay, it is even believed that flies often convey the infection, when, after having gorged themselves with the virulent matter by sucking the ulcers of those who are diseased, they make punctures in the skin of such as are sound, and thus inoculate them; in consequence of which the disorder will soon appear, provided the *morbific disposition* of body be present.

Prognosis. The yaws are not dangerous, if the cure be

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be skilfully managed at a proper time; but if the patient has been prematurely salivated, or has taken any quantity of mercury, and his skin been suddenly cleared thereby, the cure will be very difficult, if not impracticable.

Cure. In attempting the cure of this disease, the four following indications are chiefly to be held in view:

1. To support the strength of the patient.
2. To promote excretion by the skin.
3. To correct the vitiated fluids.
4. To remove and counteract the injuries done either to the constitution in general, or to particular parts by the disease.

With the first of these intentions, a liberal diet, consisting of a considerable quantity of animal food, with a considerable proportion of wine, and gentle exercise, are to be employed: but the cure is principally to be effected by mercurial salivation, after the virulent matter has been completely thrown out to the surface of the body by sudorifics. The following are the particular directions given on this head by the author of the article in the Medical Essays. The yaws being an infectious disease, as soon as they begin to appear on a negro, he must be removed to a house by himself; or if it is not certain whether the eruption be the yaws or not, shut him up seven days, and look on him again, as the Jews were commanded to do with their lepers, and in that time you may be commonly certain.

As soon as you are convinced that it is the yaws, give a bolus of flowers of sulphur, with camphor and theriaca. Repeat this bolus every night for a fortnight or three weeks, or till the yaws come to the height; that is, when they neither increase in size or number: then throw your patient into a gentle salivation with calomel given in small doses, without farther preparation; five grains repeated once, twice, or thrice a-day, is sufficient, as the patient can bear it. If he spits a quart in 24 hours, it is enough. Generally, when the salivation is at this height, all the yaws are covered with a dry scaly crust or scab; which, if numerous, look terribly. These fall off daily in small white scales; and in ten or twelve days leave the skin smooth and clean. Then the calomel may be omitted, and the salivation permitted to go off of itself. A dram of corrosive sublimate dissolved in an ounce of rum or brandy, and the solution daubed on the yaws, will, it is said, in general clear the skin in two days time.

After the salivation, sweat the patient twice or thrice in a frame or chair with spirits of wine; and give an alterative electuary, of æthiops and gum guaiac. He may likewise use the decoction of guaiacum and sassafras fermented with melasses, for his constant drink while the electuary is taking, and a week or a fortnight after the electuary is finished.

The master-yaw must be consumed an eighth or a tenth of an inch below the skin, with *Mercur. corros. rub. & alum. ust. an. part. æqual.* and digested with *Ung. basil. flav.* ℥j. and *mercur. corros. rub.* ʒj. and cicatrized with lint pressed out of spirits of wine, and with the vitriol of copper.

After the yaws are cured, some patients are afflicted with carbuncles in their feet; which sometimes render them incapable of walking, unless with pain. The method of cure is, by bathing and paring, to destroy the cuticle, and then proceed as in the master-yaw. The gentle escharotics are to be preferred, especially here; and all imaginable care is to be taken to avoid the tendons and periosteum.

Trichoma.

To children under six or seven years old, at the proper time of salivating, when the yaws are come to their full growth, give a grain or two of calomel in white sugar, once a-day, once in two days, or once in three days, so as only to keep their mouths a little sore till the yaws dry, and, falling off in white scales, leave the skin clean. This succeeds always, but requires a longer time than in adults.

In St Domingo they salivated by unction: but it does not appear that success always followed this practice. It is also usual in that island to give the solution of corrosive sublimate along with a decoction of sarsaparilla. Twelve ounces of this root, and 12 pounds of the coarsest sugar, macerated for 15 days in 12 quarts of water, is mentioned as a specific, and said to be the prescription of an English physician; the dose is four ounces every sixth hour.

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Genus XC. TRICHOMA.
The Plica Polonica, or *Plaited Hair.*

Trichoma, *Sauv.* gen. 311. *Sag.* 137.
Plica, *Lin.* 313.
Plica sive Rhopalosis, *Vog.* 323.

This disorder is only met with in Poland and Lithuania, and consists of several blood-vessels running from the head into the ends of the hairs; which cleave together, and hang from the head in broad flat pieces, generally about an ell in length, but sometimes they are five or six yards long; one patient hath more or less of these, up to 20, and sometimes 30. They are painful to the wearer, and odious to every spectator. At the approach of winter an eruptive fever happens to many in these countries: the eruptions principally infest the head, and when at the height an ichorous humour flows from them. In this state they are too tender to admit of being touched, and the matter running down the hairs mats them together; the skin by degrees breaking, the ramifications of the capillary vessels following the course of the hair, or prolonged out of the skin are increased to a vast length.

No method of relief is yet known; for if the discharge be checked, or the vessels cut off, the consequence is an increase of more miserable symptoms, and in the end death. Sennertus says, when all the morbid matter is thrown out of the body the plicæ fall off spontaneously. He further observes, that the only safe practice in this case is, to solicit the peccant matter to the hairs, to which it naturally tends; and that this is best answered by lotions of bear's breech. Some say that a decoction of the herb club-moss, and its seeds, with which the head is to be washed, is a specific.

Genus XCI. ICTERUS. 356
The Jaundice.

Icterus, *Lin.* 244. *Vog.* 306. *Boerh.* 918. *Junck.* 90.
Aurigo, *Sauv.* gen. 306. *Sag.* 132.
Cachexia icterica, *Hoffm.* III. 301.

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Description. The jaundice first shows itself by a listlessness and want of appetite, the patient becomes dull, oppressed, and generally costive. These symptoms have continued but a very short time, when a yellow colour begins to diffuse itself over the *tunica albuginea* or white part of the eye, and the nails of the fingers; the urine becomes high coloured, with a yellowish sediment capable of giving a yellow tinct to linen; the stools are whitish or grey. In some there is a most violent pain in the epigastric region, which is considerably increased after meals. Sometimes the patient has a continual propensity to sleep; but in others there is too great watchfulness; and sometimes the pain is so great, that though the patient be sleepy he cannot compose himself to rest. The pains come by fits; and most women who have had the jaundice and born children, agree, that they are more violent than labour-pains. As the disease increases, the yellow colour becomes more and more deep; an itching is felt all over the skin; and even the internal membranes of the viscera, the bones, and the brain itself, become tinged, as hath been shown from dissections, where the bones have been found tinged sometimes for years after the jaundice has been cured.

In like manner, all the secretions are affected with the yellow colour of the bile, which in this disease is diffused throughout the whole mass of fluids. The saliva becomes yellowish and bitter; the urine excessively high-coloured, in such a manner as to appear almost black; nay, the blood itself is sometimes said to appear of a yellow colour when drawn from a vein; yet Dr Heberden says that he never saw the milk altered in its colour, even in cases of very deep jaundice. In process of time the blood begins to acquire a tendency to dissolution and putrefaction; which is known by the patient's colour changing from a deep yellow to a black or dark yellow. Hæmorrhagies ensue from various parts of the body, and the patients frequently die of an apoplexy; though in some the disease degenerates into an incurable dropsy; and there have not been wanting instances of some who have died of the dropsy after the jaundice itself had been totally removed.

Causes. As the jaundice consists in a diffusion of the bile throughout the whole system, it thence follows, that whatever may favour this diffusion is also to be reckoned among the causes of jaundice. Many disputes have arisen concerning the manner in which the bile is resorbed into the blood; but it is now generally agreed that it is taken up by the lymphatics of the gall-bladder and biliary ducts. Hence, a jaundice may arise from any thing obstructing the passage of the bile into the duodenum, or from any thing which alters the state of the lymphatics in such a manner as to make them capable of absorbing the bile in its natural state. Hence the jaundice may arise from scirrhi of the liver or other viscera pressing upon the biliary ducts, and obstructing the passage of the bile; from flatus distending the duodenum, and shutting up the entrance of the ductus communis choledochus into it; from the same orifice being plugged up by viscid bile or other sordes; but by far the most frequent cause of jaundice is the formation of calculi, or more properly biliary concretions: for although they were long considered as being of a calcareous nature, yet more accurate experiments have now demonstrated, that they consist principally of a sebaceous matter; accordingly, while they are so light as to swim in water, they are also highly inflammable. These are found of almost all sizes, from that of a small pea to that of a walnut, or bigger: they are of different colours; and sometimes appear as if formed in the inward part by crystallization, but of lamellæ on the outer part; though sometimes the outward part is covered with rough and shining crystals, while the inward part is lamellated. These enter into the biliary ducts and obstruct them, causing a jaundice, with a violent pain for some time; and which can be cured by no means till the concretion is either passed entirely through the ductus communis or returned into the gall-bladder. Sometimes, in the opinion of many celebrated physicians, the jaundice is occasioned by spasmodic constrictions of the biliary ducts; but this is denied by others, and it is not yet ascertained whether these ducts are capable of being affected by spasm or not, as the existence of muscular fibres in them has not with certainty been discovered. It cannot, however, be denied, that violent fits of passion have often produced jaundice, sometimes temporary, but frequently permanent. This has been by some deemed a sufficient proof of the spasmodic contraction of the ducts; but their opponents suppose, that the agitation occasioned by the passion might push forward some biliary concretion into a narrow part of the duct, by which means a jaundice would certainly be produced, till the concretion was either driven backward or forward into the duodenum altogether. But even supposing the ducts themselves to be incapable of spasm, yet there can be no doubt that by a spasm of the intestines biliary concretions may be retained in the ducts; and indeed it is principally where the duct entering obliquely into the intestines forms as it were a species of valve that these concretions are retained.

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In a very relaxed state of the body there is also an absorption of the bile, as in the yellow fever; and indeed in all putrid disorders there is a kind of yellowish tinct over the skin, though much less than in the true jaundice. The reason of this is, that in these disorders there is usually an increased secretion of bile, commonly of a thinner consistence than in a healthy state, while the orifices of the lymphatics are probably enlarged, and thus ready to absorb a fluid somewhat thicker than what they ought to take up in a healthy state; but these diseases are of short duration in comparison with the real jaundice, which sometimes lasts for many years. These affections, however, cannot with propriety in any case be considered as real instances of jaundice; for to constitute that disease, bile must not only be present in the blood, but wanting in the alimentary canal.

It is observable, that women are more subject to jaundice than men, which probably arises from their more sedentary life; for this, together with some of the depressing passions of the mind, are found to promote the accession of the disease, if not absolutely to produce it. Pregnant women are also frequently attacked by the jaundice, which goes off after their delivery.

Prognosis. As jaundice may arise from many different causes, some of which cannot be discovered during the patient's life, the prognosis must on this account be very uncertain. The only cases which admit of

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of a cure are those depending upon biliary concretions, or obstructions of the biliary ducts by viscid bile; for the concretions are seldom of such a size that the ducts will not let them pass through, though frequently not without extreme pain. Indeed this pain, though so violent, and almost intolerable to the sick person, affords the best prognosis; as the physician may readily assure his patient that there is great hope of his being relieved from it. The coming on of a gentle diarrhœa, attended with bilious stools, together with the cessation of pain, are signs of the disease being cured. We are not however, always to conclude, because the disease is not attended with acute pain, that it is therefore incurable; for frequently the passage of a concretion through the biliary ducts is accompanied only with a sensation of slight uneasiness.

Cure. The great object to be aimed at in the cure of jaundice is unquestionably the removal of the cause which obstructs the passage of bile into the intestine: But before this can be accomplished, practices are often necessary for alleviating urgent symptoms; which may be done sometimes by supplying the want of bile in the alimentary canal, sometimes by affording an exit for bilious matter from the general mass of blood, but most frequently by obviating the effects of distension and obstruction to the circulation in the system of the liver.

The measures to be employed for the removal of the obstruction must depend very much on the nature of the obstructing cause.

When the jaundice arises from indurated swellings or scirrhi of the viscera, it is absolutely incurable; nevertheless, as these cannot always be discovered, the physician ought to proceed in every case of jaundice as if it arose from calculi. The indications here are, 1. To dissolve the concretions; and, 2. To prevent their formation a second time. But unhappily the medical art has not yet afforded a solvent for biliary concretions. They cannot even be dissolved when tried out of the body either by acids or alkalies, or any thing but a mixture of oil of turpentine and spirit of wine; and these substances are by far too irritating to be given in sufficient quantity to affect a concretion in the biliary ducts. Boerhaave observes, that diseases of the liver are much more difficult to cure than those in any other part of the body; because of the difficulty there is in getting at the part affected, and the tedious and round-about passage the blood hath to it. The juice of common grass has indeed been recommended as a specific in the jaundice, but on no very good foundation. Glisson observes, that black cattle are subject to biliary concretions when fed with hay or dried straw in winter, but are cured by the succulent grass in the spring; and Van Swieten tells a strange story of a man who cured himself of the jaundice by living almost entirely on grass, of which he devoured such quantities, that the farmers were wont to drive him out of their fields; but other practitioners have by no means found this in any degree effectual. The only method of cure now attempted in the jaundice is to expel the concretion into the intestines; for which vomits and exercise are the principal medicines. The former are justly reckoned the most efficacious medicines, as they powerfully shake all the abdominal and thoracic viscera; and thus tend to dislodge any obstructing matter that may be contained in them. But if there be a tendency to inflammation, vomits must not be exhibited till bleeding has been premised. We must also proceed with caution if the pain be very sharp; for in all cases where the disease is attended with violent pain, it will be necessary to allay it by opiates before the exhibition of an emetic. There is also danger, that by a continued use of vomits, a concretion which is too large to pass, may be so impacted in the ducts, that it cannot even be returned into the gall-bladder; which would otherwise have happened. In all cases, therefore, if no relief follows the exhibition of the second or third emetic, it will be prudent to forbear their farther use for some time.

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Of all kinds of exercise, that of riding on horseback is most to be depended upon in this disease. It operates in the same manner with vomits, namely, by the concussion it gives to the viscera; and therefore the cautions necessary to be observed in the use of vomits are also necessary to be observed in the use of riding. Cathartics also may be of service, by cleansing the *primæ viæ*, and soliciting a discharge of the bile into the intestines; but they must not be of too drastic a nature, else they may produce incurable obstructions, by bringing forward concretions that are too large to pass. Anodynes and the warm bath are serviceable by their relaxing quality; and there can be no doubt that, from acting as powerful antispasmodics, they often give an opportunity for the discharge of concretions by very slight causes, when they would otherwise be firmly retained. Soap has been supposed to do service as a solvent; but this is now found to be a mistake, and it acts in no other way than as a relaxant or as a gentle purgative.

But when all means of relief fail, as in cases of scirrhous, we can then only attempt to palliate the symptoms, and preserve the patients's life as long as possible. This is best accomplished by diuretics; for thus a great quantity of bilious matter is evacuated, and the system is freed from the bad consequences which ensue on its stagnation in the habit. But even this is by no means equal to the common evacuation by stool; nor can all the attempts to supply the want of bile in the intestines by bitters and other stomachics restore the patient to his wonted appetite and vigour. If the pain be very violent, we must on all occasions have recourse to opiates; or if the blood has acquired a tendency to dissolution, it must be counteracted by proper antiseptics.

If the disease goes off, its return must be prevented by a course of tonic medicines, particularly the Peruvian bark and antiseptics: but we can by no means be certain that the jaundice will not return, and that at any interval; for there may be a number of concretions in the gall-bladder, and though one hath passed, another may very quickly follow, and produce a new fit of jaundice; and thus some people have continued to be affected with the distemper, at short intervals, during life.

In the East-Indies, mercury has been lately recommended as exceedingly efficacious in disorders of the liver, especially those which follow intermitting and remitting fevers. Dr Monro, in his observations on the means of preserving the health of soldiers, acquaints us, that he has seen some icteric cases which, he thought, received,

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received benefit from taking a few grains of *mercurius dulcis* at night and a purge next morning; and this repeated two or three times a-week.

Infants are subject to a temporary jaundice, commonly called the *gum*, soon after birth, the cause of which is not well understood. It differs remarkably from the common jaundice; as, in the latter, the disease is first discoverable in the white of the eyes; but though the skin of infants in the gum is all over yellow, their eyes always remain clear. The disorder goes off spontaneously, or by the use of a gentle purgative or two.

357 CLASS IV. LOCALES.

VITIA, *Sauv.* Class I. *Lin.* Cl. XI. *Vog.* Cl. X. *Sag.* Cl. I.

Plagæ, *Sag.* Cl. II.
Morbi organici Auctorum.

358 ORDER I. DYSÆSTHESIÆ.

Dysæsthesiæ, *Sauv.* Cl. VI. Ord. I. *Sag.* Cl. IX. Ord. I.

359 GENUS XCII. CALIGO.
The CATARACT.

Caligo, *Sauv.* gen. 153. *Vog.* 288. *Sag.* gen. 259.
Cataracta, *Lin.* 109.

A *cataract* is an obstruction of the pupil, by the interposition of some opaque substance which either diminishes or totally extinguishes the sight. It is generally an opacity in the crystalline humour. In a recent or beginning *cataract*, the same medicines are to be used as in the *gutta serena*; and they will sometimes succeed. But when this does not happen, and the cataract becomes firm, it must be couched, or rather extracted; for which operation, see SURGERY.—Dr Buchan says he has resolved a recent cataract by giving the patient some purges with calomel, keeping a poultice of fresh hemlock constantly upon the eye, and a perpetual blister on the neck.

There is, however, but little reason to suppose that these practices will frequently succeed. A resolution can only be effected here by an absorption of the opaque matter; and where this is possible, there is perhaps a better chance of its being effected by the agency of the electric fluid than by any other means. For this purpose electricity is chiefly applied under the form of the *electric aura*, as it has been called; but even this is very rarely successful.

360 GENUS XCIII. AMAUROSIS.
The GUTTA SERENA.

Amaurosis, *Sauv.* gen. 155. *Lin.* 110. *Vog.* 238. *Sag.* 261.
Amblyopia, *Lin.* 108. *Vog.* 236.

A *gutta serena* is an abolition of the sight without any apparent cause or fault in the eyes. In every case it depends on an affection of some part of the optic nerve. But the affections which may produce this disease are of different kinds. When it is owing to a decay or wasting of the optic nerve, it does not admit of a cure; but when it proceeds from a compression of the nerves by redundant humours, these may be in some measure drained off, and the patient relieved. For this purpose, the body must be kept open with the laxative mercurial pills. If the patient be young, and of a sanguine habit, he may be bled. Cupping with scarifications on the back part of the head will likewise be of use. A running at the nose may be promoted by volatile salts, stimulating powders, &c. But the most likely means of relieving the patient, are issues or blisters kept open for a long time on the back part of the head, behind the ears, or on the neck; which have been known to restore sight even after it had been for a considerable time lost.—Should these fail, recourse must be had to a mercurial salivation; or, what will perhaps answer the purpose better, 12 grains of the corrosive sublimate mercury may be dissolved in an English pint and a half of brandy, and a table-spoonful of it taken twice a-day, drinking half a pint of the decoction of sarsaparilla after it.—Of late electricity has been much celebrated as efficacious, when no other thing could do service, and here it has in some degree the same chance of success as in other cases of insensibility, depending on an affection of the nerves, in some of which it has certainly in particular cases been of use.

Amaurosis.

In the amaurosis, Dr Porterfield observes, that it is of the utmost consequence to know of how long standing the disease has been; which is not always easily done if one eye only be affected. This is a very essential point; because an amaurosis of long standing is altogether incurable. Mr Boyle mentions the case of a man who had a cataract for several years without knowing it himself, though others did. He discovered it at last by happening to rub his sound eye, and was surprised to find himself in the dark. When a person therefore has a gutta serena only in one of the eyes, he may think that the eye has but lately lost the power of sight; though this perhaps has been the case for several years. On the other hand, he may imagine that a recent disease of this kind is really of long standing. But by inquiring at what time he first became subject to mistakes in all actions that require the distance to be exactly distinguished, as in pouring liquor into a glass, snuffing a candle, threading a needle, we may discover the age of the disease, and thence be assisted to form a more just prognostic with respect to its cure. Dr Porterfield gives an instance of his conjecturing in this manner concerning the case of a young lady who had discovered a loss of sight in one of her eyes only the day before. The disease was thought to be of long standing; but as the Doctor found that she had only been subject to mistakes of the kind abovementioned for about a month, he drew a favourable prognostic, and the disease was cured.

361 GENUS XCIV. DYSOPIA.
DEPRAVED VISION.

Amblyopia, *Sauv.* gen. 154. *Sag.* 258.

There are several species referred to this genus by Dr Cullen, *viz.*

1. *Dysopia* TENEBRARUM; 2. *Dysopia* LUMINIS.—The former of these is properly the *nyctalopia*, or night-blindness,

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blindneſs, of ancient authors. But amongſt both the Greek and Latin writers, there is a direct oppoſition in the uſe of this word *nyctalopia*; ſome ſaying it ſignifies "thoſe who *cannot* ſee by night," and others expreſs by it "thoſe who cannot ſee during the day, but during the *night*."—The difference in the account of this diſorder, as to its appearing in the night or in the day, is reconciled by conſidering it as of the intermitting kind: the difference then will conſiſt in the different times of its approach; ſo it may be called *periodical blindneſs*. Intermittents appearing in a variety of modes, and the ſucceſs of the bark in ſome inſtances of this ſort of blindneſs, both favour the opinion of its being an intermittent diſeaſe of the eyes; and this view has accordingly been taken of it by ſome late writers, particularly in ſome papers in the London Medical Obſervations, and Medical Tranſactions.

3. *Dyſopia* PROXIMORUM (*Preſbytia*), or the defect of thoſe who *ſee only at too great diſtance*. 4. *Dyſopia* DISSITORUM (*Myopia*), or the defect of thoſe who are *ſhortſighted*.—Theſe are diſorders which depend on the original ſtructure or figure of the eye, therefore admit of no cure. The inconveniences ariſing from them may, however, be in ſome meaſure remedied by the help of proper glaſſes, The former requires the aid of a convex, and the latter of a concave glaſs.

5. *Dyſopia* LATERALIS; a defect by which objects cannot be viewed diſtinctly but in an oblique poſition. —Thus, in viewing an object placed on the left, they turn their face and eye to the right, and *vice verſa*.—This diſorder may proceed from various cauſes both natural and accidental, ſome of which admit of no remedy. If it be occaſioned by a partial adheſion of the eye-lids, the hand of the ſurgeon is required: if by a tranſverſe poſition of the pupil, ſome mechanical contrivance is neceſſary. If it be owing to an *albugo* covering part of the pupil, or to a film rendering a portion of the cornea opaque, the remedies for theſe affections are to be here applied.

362 GENUS XCV. PSEUDOBLEPSIS.
IMAGINARY VISION of Objects which do not exiſt.

Suffuſio, *Sauv.* gen. 217. *Sag.* 329.
Phantaſma, *Lin.* 73. *Sag.* 289.

This very often takes place when the body is diſeaſed, and then the patient is ſaid to be delirious. Sometimes, however, in theſe caſes, it does not amount to delirium; but the perſon imagines he ſees gnats or other inſects flying before his eyes, or ſometimes, that every thing he looks at has black ſpots in it, which laſt is a very dangerous ſign. Sometimes alſo ſparks of fire appear before the eyes; which appearances are not to be diſregarded, as they frequently precede apoplexy or epilepſy. Sometimes, however people have been affected in this manner during life without feeling any other inconvenience. Such a diſorder can rarely if ever be cured.

363 GENUS XCVI. DYSECOEA.
DEAFNESS, or *Difficulty of Hearing*.

364 GENUS XCVII. PARACUSIS.
Depravation of HEARING,

Paracuſis, *Sauv.* gen. 159. *Sag.* 265.
Syrigmus, *Sauv.* gen. 219. *Sag.* 231.

Paracuſis.

The functions of the ear may be injured by wounds, ulcers, or any thing that hurts its fabric. The hearing may likewiſe be hurt by exceſſive noiſe; violent colds in the head; fevers; hard wax, or other ſubſtances ſticking in the cavity of the ear; too great a degree of moiſture or dryneſs of the ear. Deafneſs is very often the effect of old age, and is incident to moſt people in the decline of life. Sometimes it is owing to an original fault in the ſtructure or formation of the ear itſelf. When this is the caſe it admits of no cure; and the unhappy perſon not only continues deaf, but generally likewiſe dumb, for life.

When deafneſs is the effect of wounds or ulcers of the ears, or of old age, it is not eaſily removed. When it proceeds from cold applied to the head, the patient muſt be careful to keep his head warm, eſpecially in the night; he ſhould likewiſe take ſome gentle purges, and keep his feet warm, and bathe them frequently in lukewarm water at bed-time. When deafneſs is the effect of a fever, it generally goes off after the patient recovers. If it proceeds from dry wax ſticking in the ears, it may be ſoftened by dropping oil into them; afterwards they muſt be ſyringed with warm milk and water.

If deafneſs proceeds from dryneſs of the ears, which may be known by looking into them, half an ounce of the oil of ſweet almonds, and the ſame quantity of camphorated ſpirit of wine, or tincture of aſafœtida, may be mixed together, and a few drops of it put into the ear every night at bed-time, ſtopping them afterwards with a little wool or cotton. Some, inſtead of oil, put a ſmall ſlice of the fat of bacon into each ear which is ſaid to anſwer the purpoſe very well.—When the ears abound with moiſture, it may be drained of by an iſſue or ſeton, which ſhould be made as near the affected parts as poſſible.

Some, for the cure of deafneſs, recommend the gall of an eel mixed with ſpirit of wine, to be dropped into the ear; others, equal parts of Hungary-water and ſpirit of lavender. Etmuller extols amber and muſk; and Brookes ſays, he has often known hardneſs of hearing cured by putting a grain or two of muſk into the ear with cotton-wool. Where, however, an application with conſiderable ſtimulant power is neceſſary, camphorated oil, with the addition of a few drops of volatile alkaline ſpirit, may be conſidered as one of the beſt. It is proper however, to begin with a ſmall quantity of the alkali, increaſing it as the ear is found to bear it. In ſome inſtances, where deafneſs depends on a ſtate of inſenſibility in the nerves, electricity, particularly under the form either of ſparks or of the electric aura, has been employed with great ſucceſs. But theſe and other applications muſt be varied according to the cauſe of the diſorder.

Though ſuch applications may ſometimes be of ſervice, yet they much oftener fail, and frequently they do hurt. Neither the eyes nor ears ought to be tampered with; they are tender organs, and require a very delicate touch. For this reaſon, what we would chiefly recommend in deafneſs, is to keep the head warm. From whatever cauſe this diſorder proceeds, this is always proper; and more benefit has often been derived from it alone, in the moſt obſtinate caſes of deafneſs, than from any medicines whatever.

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Genus XCVIII. ANOSMIA.
Defect of Smelling.

Anoſmia, *Sauv.* gen. 156. *Lin.* 113. *Vog.* 248. *Sag.* 262.

Cauſes. Morbid affections in the ſenſe of ſmelling, may be conſidered with reſpect to their cauſes, as ariſing from one of two ſources; either from ſome organic affection of the parts here principally concerned, or from a mere atonic ſtate of the parts without any obvious affection. The ſenſe of ſmelling may be diminiſhed or deſtroyed by various diſeaſes of the parts; as, the moiſture, dryneſs, inflammation or ſuppuration of that membrane which lines the inſide of the noſe commonly called the *olfactory membrane;* the compreſſion of the nerves which ſupply this membrane, or ſome fault in the brain itſelf at their origin. A defect, or too great a degree of ſolidity of the ſmall ſpongy bones of the upper jaw, the caverns of the forehead, &c. may likewiſe impair the ſenſe of ſmelling. It may alſo be injured by a collection of fetid matter in thoſe caverns, which keeps conſtantly exhaling from them. Few things are more hurtful to the ſenſe of ſmelling than taking great quantities of ſnuff.

Cure. When the noſe abounds with moiſture, after gentle evacuations, ſuch things as tend to take off irritation and coagulate the thin ſharp ſerum may be applied; as the oil of aniſe mixed with fine flour, camphire diſſolved in oil of almonds, &c. The vapours of amber, frankincenſe, gum-maſtic, and benjamin, may likewiſe be received into the noſe and mouth. For moiſtening the mucus when it is too dry, ſome recommend ſnuff made of the leaves of marjoram, mixed with oil of amber, and aniſeed; or a ſternutatory of calcined white vitriol, 12 grains of which may be mixed with two ounces of marjoram-water and filtrated. The ſteam or vapour of vinegar thrown upon hot iron received up the noſtrils is likewiſe of uſe for ſoftening the mucus, opening obſtructions, &c.

If there be an ulcer in the noſe, it ought to be dreſſed with ſome emollient ointment, to which, if the pain be very great, a little laudanum may be added. If it be a venereal ulcer, it is not to be cured without mercury. In that caſe, the ſolution of the corroſive ſublimate in brandy may be taken, as directed in the gutta ſerena. The ulcer ought likewiſe to be waſhed with it; and the fumes of cinnabar may be received up the noſtrils.

If there be reaſon to ſuſpect that the nerves which ſupply the organs of ſmelling are inert or want ſtimulating, volatile ſalts, ſtrong ſnuffs, and other things which occaſion ſneezing, may be applied to the noſe. The forehead may likewiſe be anointed with balſam of Peru, to which may be added a little of the oil of amber.

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Genus XCIX. AGEUSTIA.
Defect of Tasting.

Ageuſtia, *Sauv.* gen. 157. *Sag.* 263.
Ageuſtia, *Lin.* 114.
Apogeuſis, *Vog.* 449.

Cauſe. This diſeaſe alſo may ariſe either from an organic affection, or an atonic ſtate of the parts. The taſte may be diminiſhed by cruſts, filth, mucus, aphthæ, pellicles, warts, &c. covering the tongue; it may be depraved by a fault of the ſaliva, which being diſcharged into the mouth, gives the ſame ſenſation as if the food which the perſon takes had really a bad taſte; or it may be entirely deſtroyed by injuries done to the nerves of the tongue and palate. Few things prove more hurtful either to the ſenſe of taſting or ſmelling than obſtinate colds, eſpecially thoſe which affect the head. Ageuſtia.

Cure. When the taſte is diminiſhed by filth, mucus, &c. the tongue ought to be ſcraped, and frequently waſhed with a mixture of water, vinegar, and honey, or ſome other detergent. When the ſaliva is vitiated, which ſeldom happens unleſs in fevers or other diſeaſes, the curing of the diſorder is the cure of this ſymptom. To relieve it, however in the mean time, the following practices may be of uſe: if there be a bitter taſte, it may be taken away by vomits, purges, and other things which evacuate bile: what is called a *nidorous taſte,* riſing from putrid humours, is corrected by the juice of citrons, oranges, and other acids: a ſalt taſte is cured by plentiful dilution with watery liquors: an acid taſte is deſtroyed by abſorbents and alkaline ſalts, as powder of oyſter-ſhells, ſalt of wormwood, &c.

When the ſenſibility of the nerves which ſupply the organs of taſte is diminiſhed, the chewing of horſe-radiſh, or other ſtimulating ſubſtances, will help to recover it.

Genus C. ANÆSTHESIA. 367
Defect of the Senſe of Feeling.

Sauv. gen. 161. *Lin.* 218. *Vog.* 267.

Cauſes, &c. This ſenſe may be hurt by any thing that obſtructs the nervous influence, or prevents its being regularly conveyed to the organs of touching, as preſſure, extreme cold, &c. It may likewiſe be hurt by too great a degree of ſenſibility, when the nerve is not ſufficiently covered by the cuticle or ſcarf-ſkin, or where there is too great a tenſion of it, or it is too delicate. Whatever diſorders the functions of the brain and nerves, hurts the ſenſe of touching. Hence it appears to proceed from the ſame general cauſes as palſy and apoplexy, and requires nearly the ſame method of treatment.

In a *ſtupor,* or defect of touching, which ariſes from an obſtruction of the cutaneous nerves, the patient muſt firſt be purged; afterwards ſuch medicines as excite the action of the nerves, or ſtimulate the ſyſtem, may be uſed. For this purpoſe, the ſpirit of hartſhorn, either by itſelf or combined with eſſential oils, horſe-radiſh, &c. may be taken inwardly; the diſordered parts, at the ſame time, may be frequently rubbed with freſh nettles or ſpirits of ſal ammoniac. Bliſters and ſinapiſms applied to the parts will likewiſe be of uſe; and alſo warm bathing, eſpecially in the natural hot-baths.

Order II. DYSOREXIÆ. 368
Sect. I. *APPETITUS ERRONEI.*

Moroſitates, *Sauv.* Claſs VIII. Order II. *Sag.* Claſs XIII. Order II.

Pathetici,

Dysorexiæ

Pathetici, *Lin.* Class V. Order II.
Hyperæsthefes, *Vog.* Class VII.

369 GENUS CI. BULIMIA.
INSATIABLE HUNGER, or *Canine Appetite.*

Bulimia, *Sauv.* gen. 223. *Lin.* 79. *Sag.* gen. 335.
Bulimus, *Vog.* 296.
Addephagia, *Vog.* 297.
Cynorexia, *Vog.* 298.

This disease is commonly owing to some fault in the stomach, by which the aliments are thrown out too soon; and unless the person be indulged in his desire for eating, he frequently falls into fainting fits. Sometimes it is attended with such a state of the stomach, that the aliment is rejected by vomit almost immediately after being swallowed; after which the appetite for food returns as violent as ever. But there are many circumstances which seem to render it probable that it more frequently arises from a morbid condition of the secreted fluid poured into the stomach, by means of which the aliment is dissolved. When the activity of this fluid is morbidly increased, it will both produce too sudden a solution of the solid aliment, and likewise operate as a powerful and peculiar stimulus to the stomach, giving an uneasy sensation, similar to that which takes place in natural hunger. Such things are proper for the cure as may enable the stomach to perform its office: chalybeates and other tonics will generally be proper. In some, brandy drunk in a morning has been useful; and frequent smoking tobacco has relieved others. Oil, fat meat, pork, opiates, and in short every thing which in a sound person would be most apt to pall the appetite, may also be used as temporary expedients, but cannot be expected to perform a cure. In some, the pylorus has been found too large; in which case the disease must have been incurable.

370 GENUS CII. POLYDIPSIA.
EXCESSIVE THIRST.

Polydipsia, *Sauv.* gen. 224. *Lin.* 80. *Vog.* 275 *Sag.* 336.

This is almost always symptomatic; and occurs in fever, dropsy, fluxes, &c. The cure is very generally obtained only by the removal of the primary disease; and it is best palliated by the gradual introduction of diluents: But when these are contraindicated, it may often be successfully obviated by such articles taken into the mouth as have effect in augmenting the flow of saliva.

371 GENUS CIII. PICA.
LONGING, or *False Appetite.*

Pica, *Sauv.* gen. 222. *Sag.* 334.
Citta, *Lin.* 78.
Allotriophagia, *Vog.* 299.
Malacia, *Vog.* 300.

The pica is also very generally symptomatic of other diseases, as of worms, chlorosis, pregnancy, &c.; and is therefore chiefly to be combated by the removal of the primary affection. It may, however, be observed, that peculiar longings occurring in certain diseases, as for example in fevers, often point out a natural cure. The indulgence of such appetites to a moderate degree is seldom productive of any inconvenience, and often followed by the best consequences.—Hence there are some practitioners who think that such craving should very generally be indulged; particularly when the patient can assign no reason whatever for such particular longings, but is merely prompted by an uncommon and inexplicable desire.

Pica.

GENUS CIV. SATYRIASIS. 372

Satyriasis, *Sauv.* gen. 228. *Lin.* 81. *Sag.* 340.

Satyriasis is a violent desire of venery in men, even so that reason is depraved by it. The pulse is quick, and the breathing short; the patient is sleepless, thirsty, and loathes his food; the urine is evacuated with difficulty, and a fever soon comes on. These symptoms, however, are probably not so much the consequence of satyriasis, as merely concomitant effects resulting from the same cause. And indeed this affection is most frequently the concomitant of a certain modification, of insanity. The nature and cause of this affection are in most instances very little ascertained; but as far as we are acquainted with the treatment, it agrees very much with the affection next to be mentioned, which, of the two, is the most common occurrence.

GENUS CV. NYMPHOMANIA. 373
FUROR UTERINUS.

Nymphomania, *Sauv.* 229. *Sag.* 341.
Satyriasis, *Lin.* 81.

The *furor uterinus* is in most instances either a species of madness or an high degree of hysterics. Its immediate cause is a preternatural irritability of the uterus and pudenda of women (to whom the disorder is proper), or an unusual acrimony of the fluids in these parts.—Its presence is known by the wanton behaviour of the patient: she speaks and acts with unrestrained obscenity; and as the disorder increases, she scolds, cries, and laughs, by turns. While reason is retained, she is silent, and seems melancholy, but her eyes discover an unusual wantonness. The symptoms are better and worse until the greatest degree of the disorder approaches, and then by every word and action her condition is too manifest.—In the beginning a cure may be hoped for; but if it continue, it degenerates into a mania.—In order to the cure, blood-letting is commonly had recourse to in proportion to the patient's strength. Camphor in doses of 15 or 20 grains, with nitre, and small doses of the tincture of opium, should be repeated at proper intervals. Some venture to give cerusa acetata in doses from three to five grains. Besides bleeding, cooling purges should also be repeated in proportion to the violence of symptoms, &c. What is useful in maniacal and hypochondriac disorders, is also useful here, regard being had to sanguine or phlegmatic habits, &c. When the delirium is at the height, give opiates to compose; and use the same method as in a phrenitis or a mania. Injections of barley-water, with a small quantity of hemlock-juice, according to Riverius, may be frequently thrown up into the uterus: this

Dyſorexiæ

this is called *ſpecific*; but matrimony, if poſſible, ſhould be preferred. For although this cannot be repreſented as a cure for the diſeaſe when in an advanced ſtate, yet there is reaſon to believe that it has not unfrequently prevented it where it would otherwiſe have taken place.

374 GENUS CVI. NOSTALGIA.
Vehement DESIRE *of* REVISITING *one's* COUNTRY.

Noſtalgia, *Sauv.* gen. 226. *Lin.* 83. *Sag.* 338.

This is to be reckoned a ſpecies of melancholy; and unleſs it be indulged, it very commonly proves not only incurable but even fatal. Although it cannot be conſidered as altogether peculiar to any nation, yet it is obſerved to be much more frequent with ſome than with others; and it has particularly been remarked among Swiſs ſoldiers in the ſervice of foreign ſtates.

SECT. II. *APPETITUS DEFICIENTES.*

Anepithymiæ, *Sauv.* Claſs VI. Ord. II. *Sag.* IX. Ord. II.
Privativi, *Lin.* Claſs VI. Order III.
Adynamiæ, *Vog.* Claſs VI.

375 GENUS CVII. ANOREXIA.
Want of APPETITE.

Anorexia, *Sauv.* gen. 162. *Lin.* 116. *Vog.* 279. *Sag.* 268.

The anorexia is ſymptomatic of many diſeaſes, but ſeldom appears as a primary affection; and it is very generally overcome only by the removal of the affection on which it depends.

376 GENUS CVIII. ADIPSIA.
Want of THIRST.

Adipſia, *Sauv.* gen. 163. *Lin.* 117. *Vog.* 281. *Sag.* 269.

This by Dr Cullen is reckoned to be always ſymptomatic of ſome diſtemper affecting the *ſenſorium commune*.

377 GENUS CIX. ANAPHRODISIA.
Impotence to VENERY.

Anaphrodiſia, *Sauv.* gen. 164. *Sag.* 270.
Atecnia, *Lin.* 119.
Ageneſia, *Vog.* 283.

For this, ſee the article IMPOTENCE in the alphabetical order.

378 ORDER III. DYSCINESIÆ.

379 GENUS CX. APHONIA.
Loſs of VOICE.

Aphonia, *Sauv.* gen. 166. *Lin.* 115. *Vog.* 253. *Sag.* 272.

The loſs of voice may proceed from various cauſes. If one of the recurrent nerves, which are formed by the *par vagum* and the *nervus acceſſorius*, and reach the larynx, be cut the perſon is capable of only as it were a half-pronunciation; but if both be cut, the ſpeech and voice are both loſt. The loſs of ſpeech happening in hyſteric patients is alſo called *aphonia*; but more properly that loſs of ſpeech is thus named which depends on ſome fault of the tongue. Aphonia.

Seeing that the motion of any part is deſtroyed, or leſſened at leaſt, by the interception of the nervous fluid in its paſſage thither, and that the nerves deſtined for the motion of the tongue ariſe principally from the fifth pair, it appears that the ſeat of this diſorder is in the ſaid fifth pair of nerves, and that the immediate cauſe is a diminution or total deſtruction of the nervous power in them. Hence a palſy of the tongue, which is either antecedent or ſubſequent to hemiplectic or apoplectic diſorders, demand our utmoſt attention.

If an aphonia appears alone, it generally beſpeaks an approaching hemiplegia or apoplexy; but if it ſucceed theſe diſorders, and is complicated with a weak memory and a ſluggiſhneſs of the mental powers, it threatens their return. That aphony uſually terminates the beſt which proceeds from a ſtagnation of ſerous humours compreſſing the branches of the fifth pair of nerves, which run to the tongue; but it is no leſs afflictive to the patient, and is very obſtinate of cure.

Other cauſes of this diſorder are, the ſtriking in of eruptions on the ſkin, a congeſtion of blood in the fauces and tongue, obſtructed periodical evacuations in plethoric habits, ſpaſmodic affections, worms, a crum of bread falling into the larynx, fear, too free an uſe of ſpirituous liquors; alſo whatever deſtroys the ligaments which go from the arytænoid to the thyroid cartilages, will deſtroy the voice.

The *prognoſtics* vary according to the cauſe or cauſes. That ſpecies which is owing immediately to ſpaſms, ſoon gives way on the removal of them. If a palſy of the tongue be the cauſe, it is very apt to return, tho' relieved, but often continues incurable.

In order to the *cure*, we muſt endeavour firſt to remove whatever obſtructs the influx of the nervous fluid into the tongue, and ſecondly to ſtrengthen the weak parts. Theſe general intentions, in all caſes, being regarded, the particular cauſes muſt be removed as follows:

If worms be the cauſe, antiſpaſmodics may give preſent relief; but the cure depends on the deſtruction or expulſion of the animals themſelves. In caſe of a congeſtion of blood about the head, bleeding and nitrous medicines are to be uſed.—That ſpecies of aphony which remains after the ſhock of an hemiplegia or apoplexy, requires bliſters to be applied to the nape of the neck; other means are rarely effectual.—If ſpaſmodic conſtrictions about the fauces and tongue be the cauſe, external paregorics are of the greateſt ſervice, anodyne antiſpaſmodics may be laid under the tongue, and the feet bathed in warm water; carminative clyſters alſo are uſeful.—When a palſy of the tongue produces this complaint, evacuations, according to the patient's habit, muſt be made, and warm nervous medicines muſt be externally applied, and internally adminiſtered; bliſters alſo ſhould be placed between the ſhoulders.—In caſe of repelled cuticular eruptions, ſudorifics ſhould be given, and the patient's drink ſhould be warm. The ſpiritus ammoniæ ſuccinatus, or vinum antimonii, may be employed either in combination

tion with other articles or by themſelves, and given, at proper diſtances of time, in the patient's drink, or on a lump of ſugar.—Sometimes the ſerum flows ſo rapidly to the fauces and adjacent parts, in a ſalivation, as to deprive the patient of all power to ſpeak; in this caſe diaphoretics and laxatives, with a forbearance of all mercurials, are the ſpeedieſt remedies.

380 GENUS CXI. MUTITAS, DUMBNESS.

Mutitas, *Sauv.* gen. 165. *Vog.* 257. *Sag.* 271.

Dumb people are generally born deaf; in which caſe the diſtemper is incurable by medicine: though even ſuch people may be taught not only to read and write, but alſo to ſpeak and to underſtand what others ſay to them. For ſome obſervations on the method in which this has been accompliſhed, we may refer the reader to the article DUMBNESS in the alphabetical order. But in theſe caſes, admitting of cure in the manner above alluded to, the dumbneſs proceeds principally, if not ſolely, from the deafneſs. For when it proceeds from a defect of any of the organs neceſſary for ſpeech, the tongue for inſtance, it is always incurable; but if it ariſe from a palſy, the medicines applicable in that caſe will ſometimes reſtore the ſpeech.

381 GENUS CXII. PARAPHONIA. *Change in the Sound of the* VOICE.

Paraphonia, *Sauv.* gen. 168.
Cacophonia, *Sag.* 274.
Raucedo, *Lin.* 146.
Raucitas, *Vog.* 252.
Aſaphia, &c. *Vog.* 250, 251, 254, 255, 256.

The voice may be changed from various cauſes. In males it becomes much more hard about the time of puberty; but this can by no means be reckoned a diſeaſe. In others it proceeds from a catarrh, or what we call a *cold*; it ariſes alſo from affections of the noſe and palate, as polypi, ulcers, &c. in which caſe the cure belongs properly to SURGERY. In ſome it ariſes from a laxity of the *velum pendulum palati* and glottis, which makes a kind of ſnoring noiſe during inſpiration. The cure of this laſt caſe is to be attempted by tonics and ſuch other medicines as are of ſervice in diſeaſes attended with laxity.

382 GENUS CXIII. PSELLISMUS. *Defect in* PRONUNCIATION.

Pſelliſmus, *Sauv.* gen. 167. *Lin.* 138. *Sag.* 273.
Traulotis, &c. *Vog.* 258. 59. 260. 261.

Of this diſeaſe (if ſuch it may be called), there are many different kinds. Some cannot pronounce the letter S; others labour under the ſame difficulty with R, L, M, K, &c.; while ſome who can with ſufficient eaſe pronounce all the letters, yet repeat their words, or the firſt ſyllables of them, in ſuch a ſtrange manner, that they can ſcarce be underſtood. Very frequently theſe defects ariſe entirely from habit, and may then be got the better of by thoſe who have the reſolution to attempt it; as we are told that Demoſthenes the celebrated orator got the better of a habit of ſtammering by declaiming with pebbles in his mouth. Sometimes, however, pronunciation may be impeded by a wrong conformation of the tongue or organs of ſpeech; and then it cannot by any pains whatever be totally removed.

383 GENUS CXIV. STRABISMUS. SQUINTING.

Strabiſmus, *Sauv.* gen. 116. *Lin.* 304. *Vog.* 514. *Sag.* 222.

Deſcription. This diſeaſe ſhows itſelf by an uncommon contraction of the muſcles of the eye; whereby the axis of the pupil is drawn towards the noſe, temples, forehead, or cheeks, ſo that the perſon cannot behold an object directly.

Cauſes, Prognoſis, &c. I. This diſeaſe may proceed from cuſtom and habit; while in the eye itſelf, or in its muſcles, nothing is preternatural or defective.

Thus children by imitating thoſe that ſquint, and infants by having many agreeable objects preſented to them at once, which invite them to turn one eye to one and the other eye to another, do frequently contract a habit of moving their eyes differently, which afterwards they cannot ſo eaſily correct. Infants likewiſe get a cuſtom of ſquinting by being placed obliquely towards a candle, window, or any other agreeable object capable of attracting their ſight; for though, to ſee the object, they may at firſt turn both eyes towards it; yet becauſe ſuch an oblique ſituation is painful and laborious, eſpecially to the moſt diſtant eye, they ſoon relax one of the eyes, and content themſelves with examining it with the eye that is next it; whence ariſes a diverſity of ſituation and a habit of moving the eyes differently.

In this caſe, which may admit of a cure if not too much confirmed, it is evident, that objects will be ſeen in the ſame place by both eyes, and therefore muſt appear ſingle as to other men; but becauſe, in the eye that ſquints, the image of the object to which the other eye is directed falls not on the moſt ſenſible and delicate part of the retina, which is naturally in the axis of the eye, it is eaſy to ſee that it muſt be but faintly perceived by this eye. Hence it is, that while they are attentive in viewing any object, if the hand be brought before the other eye, this object will be but obſcurely ſeen, till the eye change its ſituation, and have its axis directed to it; which change of ſituation is indeed very eaſy for them, becauſe it depends on the muſcles of the eyes, whoſe functions are entire; but, by reaſon of the habit they have contracted of moving their eyes differently, the other eye is at the ſame time frequently turned aſide, ſo that only one at a time is directed to the object.

That all this may be the better perceived; for an object, cauſe them to look at the image of the upper part of your noſe in a plain mirror, while you ſtand directly behind them, to obſerve the direction of their eyes.

II. The *ſtrabiſmus* may proceed from a fault in the firſt conformation, by which the moſt delicate and ſenſible part of the retina is removed from its natural ſituation, which is directly oppoſite to the pupil, and is placed a little to a ſide of the axis of the eye; which obliges them to turn away the eye from the object

Dyscinesiæ they would view, that its picture may fall on this most sensible part of the organ.

When this is the case, the disease is altogether incurable, and the phænomena that arise therefrom differ in nothing from the phænomena of the former case, excepting only that here. 1. The object to which the eye is not directed will be best seen: which is the reverse of what happens when this disease arises barely from habit and custom. 2. No object will appear altogether clear and distinct: for all objects to which the eye is directed, by having their image painted in the retina at the axis of the eye, where it is not very sensible, will be but obscurely seen; and objects that are placed so far to a side of the optic axis as is necessary for making their image fall on the most sensible and delicate part of the retina, must appear a little confused, because the several pencils of rays that come therefrom fall too obliquely on the crystalline, to be accurately collected in so many distinct points of the retina; though it must be acknowledged, that this confusion will, for the most part, be so small as to escape unobserved.

III. This disease may proceed from an oblique position of the crystalline, where the rays that come directly to the eye from an object, and that ought to converge to the point of the retina, which is in the axis of the eye, are, by reason of the obliquity of the crystalline, made to converge to another point on that side of the visual axis where the crystalline is most elevated; and therefore the object is but obscurely seen, because its image falls not on the retina at the axis of the eye, where it is most sensible: But the rays that fall obliquely on the eye, will after refraction, converge to this most sensible part of the retina; and, by converging there, must impress the mind with a clearer idea of the object from whence they came. It is for this reason that the eye never moves uniformly with the other, but turns away from the object it would view, being attentive to the object to which it is not directed. When this is the case, it is in vain to expect any good from medicine.

The symptoms that naturally arise from it are, 1. The object to which the eye is directed will be but faintly seen, because its image falls on the retina where it is not very sensible. 2. The object to which the eye is not directed, by having its image painted on the retina at the axis of the eye, will be clearly perceived. But, 3. This same object must appear somewhat indistinct, because the pencils of rays that flow from it are not accurately collected in so many distinct points in the retina, by reason of their oblique incidence on the crystalline. 4. It must be seen, not in its proper place, but thence translated to some other place situated in the axis of vision. And, 5. Being thus translated from its true place, where it is seen by the other eye that does not squint, it must necessarily appear double; and the distance between the places of its appearance will be still greater, if the crystalline of the other eye incline to the contrary side.

IV. This disease may arise from an oblique position of the cornea; which, in this case, is generally more arched and prominent than what it is naturally.

When the eye has this conformation, no object to which it is directed can be clearly seen, because its image falls not on the retina at the axis of the eye; and therefore the eye turns aside from the object it would view, that its image may fall on the most sensible part of the retina. Strabismus.

When the strabismus proceeds from this cause, the prognostic and the phænomena that attend it will be much the same as in the case immediately preceding; from which nevertheless it may be distinguished by the obliquity of the cornea, which is manifest to the senses; and if the cornea be also more arched and prominent than what it is naturally, which is commonly the case, the eye will also be short-sighted.

V. This want of uniformity in the motions of our eyes, may arise from a defect, or any great weakness or imperfection, in the sight of both or either of the eyes; and this, according to Dr Porterfield, is the most common cause of this disease. The prognostic in this case is the same with that of the disease from which it proceeds.

VI. Another cause from which the strabismus may proceed, lies in the muscles that move the eye. When any of those muscles are too short or too long, too tense or too lax, or are seized with a spasm or paralysis their equilibrium will be destroyed, and the eye will, be turned towards or from that side where the muscles are faulty.

In this case, the disease frequently yields to medicine, and therefore admits of favourable prognostic; excepting only when, by a fault in the first conformation, any of the muscles are longer or shorter than their antagonist; in which case, if ever it should happen, no medicine can be of any use.

As to what concerns the optical phænomena, they are the same here as in case first: only when the disease commences not till, by custom and habit, the uniform motion of the eyes has been rendered necessary, all objects do for some time appear double; but in time they appear single.

Lastly. This want of uniformity in the motions of our eyes may proceed from a preternatural adhesion or attachment to the eye-lids: of this we have an instance in Langius. And that the same thing may also be occasioned by a tumor of any kind within the orbit, pressing the eye aside, and restraining it from following the motions of the other, is so evident, that instances need not be brought to prove it. Here also the case may admit of a favourable prognostic; and as for what concerns the optical phænomena they must be the same as in the case immediately preceding.

The *cure*. in confirmed cases, is to be effected by mechanical contrivances, by which the person may be obliged to look straight upon objects, or not see them at all; or at least that he may see with uneasiness and confusedly when he squints. In the 68th volume of the Philosophical Transactions we have an account of a confirmed case of squinting of a very uncommon kind. The patient was a boy of five years old, and viewed every object which was presented to him with but one eye at a time. If the object was presented on his right side, he viewed it with his left eye; and if it was presented on his left side, he viewed it with his right eye. He turned the pupil of that eye

Dyscinesiæ eye which was on the same side with the object in such a direction that the image of the object might fall on that part of the bottom of the eye where the optic nerve enters it. When an object was held directly before him, he turned his head a little to one side, and observed it with but one eye, viz. that most distant from the object, turning away the other in the manner above described; and when he became tired of observing it with that eye, he turned his head the contrary way, and observed it with the other eye alone, with equal facility; but never turned the axis of both eyes on it at the same time. He saw letters which were written on bits of paper, so as to name them with equal ease, and at equal distances, with one eye as with the other. There was no perceptible difference in the diameters of the irises, nor in the contractility of them after having covered his eyes from the light. These observations were carefully made by writing single letters on shreds of paper, and laying wagers with the child that he could not read them when they were presented at certain distances and in certain directions.

As from these circumstances it appeared that there was no defect in either eye, which is frequently the case with persons who squint, and hence that the disease was simply a depraved habit of moving his eyes, the disease seemed capable of a cure. A paper gnomon was made for this purpose, and fixed to a cap; and when this artificial nose was placed over his real nose, so as to project an inch between his eyes, the child, rather than turn his head so far to look at oblique objects, immediately began to view them with that eye which was next to them. But having the misfortune to lose his father soon after this method was begun to be followed, the child was neglected for six years, during which time the habit was confirmed in such a manner as seemed to leave little room to hope for a cure. The same physician, however, being again called, attempted a second time to remove the deformity by a similar contrivance. A gnomon of thin brass was made to stand over his nose, with a half circle of the same metal to go round his temples: these were covered with black silk, and by means of a buckle behind his head, and a cross-piece over the crown of his head, this gnomon was worn without any inconvenience, and projected before his nose about two inches and an half. By the use of this machine he soon found it less inconvenient to view all oblique objects with the eye next to them instead of the eye opposite to them.

After this habit was weakened by a week's use of the gnomon, two bits of wood, about the size of a goose-quill, were blackened all but a quarter of an inch at their summits; these were frequently presented to him to look at, one being held on one side the extremity of his black gnomon, and the other on the other side of it. As he viewed these, they were gradually brought forwards beyond the gnomon, and then one was concealed behind the other: by these means, in another week, he could bend both his eyes on the same object for half a minute together, and by continuing the use of the same machine, he was in a very fair way of being cured when the paper was written.

Dr Darwin, who writes the history of the above case, adds, that all the other squinting people he had occasion to attend, had one eye much less perfect than the other these patients, says he, are certainly curable by covering the best eye many hours in a day, as by a more frequent use of the weak eye, it not only acquires a habit of turning to the objects which the patient wishes to see, but gains at the same time a more distinct vision; and the better eye at the same time seems to lose somewhat in both these respects, which also facilitates the cure. Strabismus

Genus CXV. CONTRACTURA. 384
Contractions of the Limbs.

Contractura, *Sauv.* gen. 119. *Lin.* 299. *Sag.* 225.
Obstipitas, *Sauv.* gen. 11.
Caput obstipum, *Vog.* 513.
Digitium, *Vog.* 221.

The contraction of various muscles of the body is generally the consequence of some other disease, as the rheumatism, gout, scurvy, or palsy, especially that species of the latter which follows the *colica Pictonum*. It is exceedingly difficult of cure; though the warm medicinal waters are much recommended, and have sometimes done great service. Of late electricity has been found to perform surprising cures in this way.

Order IV. APOCENOSES. 385

Apocenoses, *Vog.* Class II. Ord. II.
Fluxus, *Sauv.* Class IX. *Sag.* Class V.
Morbi evacuatorii, *Lin.* Class IX.

Genus CXVI. PROFUSIO. 386
Flux of Blood

Profusio, *Lin.* 239.
Hæmorrhagia, *Vog.* 81. *Boerh.* 218.

The disease commonly known by the name of *bloody-flux*, is the putrid or contagious dysentery, a disease which has already been treated of. But independent of the discharge of blood which then takes place, hæmorrhagy may take place from the alimentary canal as well as from other parts of the system. In such instances, however, if we except the place from which the discharge occurs, the phenomena are very much the same as in menorrhagia, hæmoptysis, and other hæmorrhagies already treated of; while the disease is to be combated on the same principles and by the same remedies.

Genus CXVII. EPHIDROSIS. 387
Excessive Sweating.

Ephidrosis, *Sauv.* gen. 258. *Sag.* gen. 194.
Sudor, *Lin.* 208.
Hydropedesis, *Vog.* 121.

This is generally symptomatic; and occurs in almost all fevers, but especially in the latter stages of the hectic. Sometimes it is a primary disease, arising merely from weakness; and then easily admits of a cure by the use of the Peruvian bark, the cold bath, and other tonics.

Genus CXVIII. EPIPHORA. 388
Flux of the Lachrymal Humour.

Epiphora, *Sauv.* gen. 259. *Lin.* 172. *Vog.* 99. *Sag.* 195.

This by Sauvages is described as an involuntary effusion.

Apocenoses effusion of tears without any remarkable itching, heat, or pain. It follows long-continued opthalmias; or it may be occasioned by immoderate study, or any thing that weakens the eyes: hence it comes on about the age of 50 years, when the eyesight naturally becomes weak. It in general grows worse in the winter-time, and is very hard to cure. Some authors recommend purgatives, and blisters on the nape of the neck, in order to draw off the abundant humours; but as the disease evidently proceeds from weakness, it would rather seem proper to pursue a contrary method. Sauvages recommends to the patients to abstain from study, wine, and salted meats; and also to avoid smoke or wind, and at night to foment the eyes with an infusion of four cloves in two ounces of proof-spirit.—Hungary water, rose water with white vitriol dissolved in it, &c. have also been recommended.

389 GENUS CXIX. PTYALISMUS.
SALIVATION.

Ptyalismus, *Sauv.* gen. 261. *Lin.* 176. *Vog.* 103. *Sag.* 197.

A salivation is often symptomatic, but rarely a primary disease. Dr Cullen is of opinion, that when the latter happens to be the case, it arises from laxity; and then is to be cured by astringents and tonics. In the Medical Transactions we have the following account of a salivation brought on by a foreign substance irritating one of the parotid glands.

In the month of April 1751, a young lady about the age of 16 years, of a delicate habit, but subject to no particular complaints, perceived the beginning of a disease which afterwards proved most obstinate and loathsome, *viz.* an incessant spitting. The quantity of this discharge was different at different times, varying from one pint to two pints and an half in 24 hours. As to its quality, it seemed to be no other than the ordinary secretion of the salival glands. By so large and constant an evacuation, her strength became extremely impaired, and the most efficacious medicines had proved useless. She had taken large quantities of the Peruvian bark, both alone and combined with preparations of iron: and afterwards the fetid gums, opium, amber, alum, and the Neville-Holt-water, had in succession been given her. In the mean time an exact regimen had been prescribed: she had been ordered to ride constantly; and to confine herself to a mucilaginous diet, such as veal, calve's feet, &c. Likewise a gently opening medicine had now and then been interposed. The disease still continued unaltered, she had afterwards tried the *tinctura saturnina*; and had, at the same time, been encouraged to chew the Peruvian bark, and to swallow the saliva. But all these attempts had been vain; and after she had taken some or other of the medicines abovementioned until the end of September 1753, namely, above two years, it appeared to her physician, Sir George Baker, unreasonable to expect relief in such a case from any internal medicines whatever.

He now conceived a suspicion, that some extraneous body having accidentally found its way into the *meatus auditorius*, might possibly be the cause of this extraordinary secretion, by keeping up a continued irritation in the parotid glands. With this view he examined her ears, and extracted from them a quantity of fetid wool. How, or when, it came thither, no account could be given. Ptyalismus

To this substance he attributed the beginning of the salivation, notwithstanding that the disease did not immediately abate on the removal of the wool; as it appeared to be no improbable supposition that the discharge might be continued by the force of habit, though the original cause no longer remained.

It seemed therefore expedient to introduce some other habit, in the place of the increased secretion of saliva; which habit might afterwards be gradually left off. With this intention, he prevailed on the patient to chew perpetually a little dry bread, and to swallow it with her spittle. In a few weeks, it became necessary for her to chew the bread only at certain hours in the day; and thus, after two months, she became entirely free from a most disgustful and tedious disorder.

It is worthy of observation, that, at first, the swallowing of so much saliva frequently occasioned a nausea; and that then, for a few hours, she was obliged to spit it out as usual; and that, during the greatest part of the time, when she chewed the bread, she had a stool or two every day more than common.

GENUS CXX. ENURESIS. 390
An involuntary FLUX *of* URINE.

Enuresis, *Sauv.* gen. 264. *Lin.* 195. *Vog.* 113. *Sag.* 200.

THIS is a distemper which frequently affects children, otherwise healthy, when asleep; and is extremely disagreeable. Often it is merely the effect of laziness, and may be driven off by proper correction; but sometimes it proceeds from an atony or weakness of the sphincter of the bladder. Many ridiculous cures have been prescribed for it, and among the rest field-mice dried and powdered. Tonics are frequ ntly of use; but sometimes the distemper proves obstinate, in spite of every thing we can use. In the London Medical Observations we find blisters much recommended in this disease, when applied to the region of the os sacrum. A girl of 13 years of age had been subject to an enuresis for four years. She could retain her water but a very little time in the day-time, but it flowed continually in the night. She had taken Peruvian bark and elixir of vitriol in considerable quantities; also Valerian and the volatile julep, without effect. She was severely threatened, as the physician suspected it might arise from a bad habit; but this producing no effect, a blister was applied to the os sacrum, which in 24 hours totally removed the disease. A man aged 32, having been seized with an incontinence of urine and palsy of the lower extremities in consequence of taking a quack medicine, was cured of the incontinence of urine in 24 hours by one blister and of the palsy itself by another. A woman of 50 having been seized with an enuresis and paralytic affection of the right thigh and leg in consequence of a strain, was cured of both by a single blister. Several other cases are there mentioned, by which the power of blisters in removing this distemper seems to exceed that of every other medicine whatever.

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Genus CXXI. GONORRHOEA.

Gonorrhœa, *Sauv.* gen. 208. *Lin.* 200. *Vog.* 118. *Sag.* 204.

The gonorrhœa is a flux of viſcid matter of various colours, from the urethra in men and the vagina in women. It commonly proceeds from coition with a perſon infected with the venereal diſeaſe, and is one of the moſt common forms under which that diſeaſe ſhows itſelf.

Deſcription. The firſt ſymptoms of the diſeaſe in men are commonly a ſenſation at the end of the penis not unlike a flea-bite, together with a fullneſs of the lips of the urethra, and ſome degree of tenſion in the penis, the urinary canal feeling as if tightened, and the urine flowing in a ſmall and unequal ſtream: a little whitiſh mucus is to be ſeen about the orifice of the urethra, and oozing from it when ſlightly preſſed, eſpecially if the preſſure be made on the ſpot where the ſoreneſs is moſt felt. The diſcharge ſoon increaſes in quantity, and varies in its colour according to the degree of inflammation. The patient feels a ſenſation of heat and pain in evacuating his urine, particularly at certain ſpots of the urethra, and above all towards its orifice; and the involuntary erections to which he is ſubjected from the ſtimulus, particularly when warm in bed, occaſion a diſtortion or curvative of the penis, attended with exquiſite pain. When the inflammation is violent, the glans appears tumid and tranſparent, the tenſion extends through the whole of the penis, the perinæum is affected with ſwelling and redneſs, and even the loins, buttocks, and anus, ſympathize and afford a very uneaſy ſenſation. Sometimes the prepuce inflames about the end of the penis, and cannot be drawn back, occaſioning what is called a *phymoſis*; at other times, as in the *paraphymoſis*, it remains in an inflamed ſtate below the glans, ſo that it cannot be drawn forwards; and, if the ſtricture and inflammation be violent, may terminate in gangrene. Now and then, eſpecially when there is a phymoſis, we may perceive a hard chord extending along the back of the penis. This is an inflamed lymphatic, and may be conſidered as a prelude to a bubo. When, however, a bubo does appear, almoſt univerſally ſome ulceration is previouſly to be diſcovered about the præputium, or glans penis; which gives ground to preſume that ſome other contagious matter beſides that of gonorrhœa may have been applied to the urethra. For it is certain that matter capable of communicating the contagion of gonorrhœa to a female, is often copiouſly applied to the whole glans penis of a male for ſeveral days together without giving either ulceration or bubo.

In mild caſes, the ſeat of the diſeaſe is in the urethra, not far from its orifice; but it frequently happens that the virus inſinuates itſelf much higher up, ſo as to affect Cowper's glands, the proſtate, and parts very near to the neck of the bladder.

In the generality of caſes, the inflammation goes on increaſing for ſeveral days, commonly for a week or a fortnight; after which the ſymptoms begin to abate; and the running, when left to itſelf, gradually leſſens in quantity, and becomes whiter and thicker, till at length it totally ſtops. The colour of the mucus, however, is by no means a certain guide in theſe caſes: for in many patients it is of a yellowiſh, and ſometimes of a greeniſh hue to the very laſt; but in general it becomes more conſiſtent towards the cloſe of the diſeaſe.

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In women, the external parts of generation being fewer and more ſimple, the diſeaſe is leſs complicated than in men. Sometimes the vagina only is affected; and when this happens, the ſymptoms are very trifling: but in general it comes on with an itching and ſenſation of heat as in the other ſex; and is attended with inflammation of the nymphæ, inſide of the *labiæ*, *clitoris*, *carunculæ myrtiformes*, the orifice and ſometimes the whole of the *meatus urinarius*. Very often the deep-ſeated glands of the vagina are affected, and it is ſometimes difficult to diſtinguiſh the diſcharge of a gonorrhœa from that of the fluor albus.

Cauſes, &c. Many ingenious arguments have of late been advanced to prove, that the gonorrhœa and the lues venerea are different affections, originating from two diſtinct ſpecies of virus; and this controverſy ſtill, perhaps, remains to be decided by future facts. Certain it is, that in 19 of 20 caſes of gonorrhœa, no ſymptom whatever of ſyphilis appears; and that the diſeaſe readily admits of cure without having recourſe to thoſe remedies which are univerſally requiſite for combating the contagion of ſyphilis. It is by no means wonderful, that in ſome caſes both contagions, ſuppoſing them different, ſhould be communicated at the ſame time. Nay, caſes are by no means rare, where the contagion of itch, though eſſentially different from both, has been communicated with either. But as undeniable proof that the contagion in both caſes is preciſely the ſame, it has been alleged by ſome, that the matter of a chancre introduced into the urethra will generate a gonorrhœa, and that the diſcharge from a gonorrhœa will produce chancre, bubo, and every other ſymptom of ſyphilis. On the other hand, however, it is contended, that when experiments of this nature are conducted with the greateſt accuracy, the matter of ſyphilis uniformly produces ſyphilis, and that of gonorrhœa, gonorrhœa only. Without pretending to decide on which of theſe experiments the greateſt dependence is to be put, we may only obſerve, that while an almoſt inconceivably ſmall portion of ſyphilitic matter applied to the glans penis, from connection with an infected female, infallibly produces ſyphilis if it be not ſpeedily removed, the matter of gonorrhœa, in every inſtance of that diſeaſe, is applied to the whole ſurface of the glans penis for many days together without producing almoſt any bad effect whatever. From this, therefore, there is ground for inferring, either that it is not capable of being abſorbed, or that if abſorbed it is innocent.

But while there have been diſputes with regard to the peculiar nature of the matter in gonorrhœa, there have alſo been controverſies with reſpect to the ſource from whence it is derived. While ſome ſuppoſe it to be principally purulent matter ariſing from ulcerations, others aſſert that no ſuch ulceration is ever produced in the urethra by gonorrhœa. They contend that the increaſed ſecretion in theſe caſes is exactly ſimilar to what happens in the catarrh. But the compariſon will by no means hold good in every particular: in the latter the whole membrane of the noſe is equally irritated; whereas in the gonorrhœa, only particular parts of

Apocenoses of the urethra seem to be affected. The disease, in the generality of cases, seldom extends more than an inch and a half along that canal, and in many is confined (at least in the beginning) to a small spot about an inch from the extremity of the glans. The discharge is produced from that part of the urethra where the pain is felt; and the patient, when he voids his urine, feels no smarting till it reaches the inflamed spot: but as the disorder increases, the inflammation affects a greater number of points, just in the same manner as chancres affect different parts of the glans. It might be supposed that dissection would at once clear up this matter, and put an end to the dispute; but this is far from being the case. Dr Simmons has seen several urethras opened in persons who had a gonorrhœa at the time of their death: in three of them the surface of the urethra, as in the cases related by Morgagni, appeared for some way down of a slight red colour, and in all of them was covered with mucus; but without any appearance of ulceration, except in two dissections at Paris, in which most of the gentlemen present were convinced that they saw evident marks of it: but Dr Simmons says that the appearances were to him not sufficiently satisfactory to enable him to decide with certainty on the subject. On the other hand, when we consider that the discharge in a gonorrhœa is sometimes tinged with blood, and that when this happens a little blood-vessel is no doubt ruptured, we can have no reason to doubt that an ulceration may, and sometimes does, happen in these cases; especially as we often observe an excoriation near the orifice of the urethra. It is certain, that wherever there is considerable inflammation, there will be danger of ulceration. Besides, from a neglected or badly-treated gonorrhœa, we often see fistulas *in perineo*, and other ulcers of the urethra, penetrating through its substance, and affording a passage to the urine. And there can be no doubt that slight ulcerations of this canal often occur, and are afterwards perfectly obliterated, in a similar manner to what happens in the papillæ of the tongue, the tonsils, &c. Such an obliteration will the more readily take place in a part like the urethra, defended with mucus, and not exposed to the air, which is known to have no little effect in hardening a cicatrix.

But whether ulcers take place or not, whether the virus of gonorrhœa be precisely of the same kind with that which gives syphilis, or of a different kind, there is reason from the phenomena of the disease to conclude, that the matter first acts by mixing with the mucus at the extremity of the urethra; and that from thence it is propagated upwards, particularly where the excretories of mucus are most numerous; and that on the parts to which it is applied, it operates as a peculiar irritating cause. The consequences of this irritation will be inflammation and an increased secretion of mucus; and so far the complaint will be local. In ninety-nine cases of an hundred a local affection of this kind constitutes the whole of the disease; and of this inflammation, ulcerations within the urethra, strictures, and other local affections, may be the consequence. But whether a disease of the habit ever takes place, unless when the contagion of syphilis is communicated with that of gonorrhœa, still remains to be determined by future observations and experiments. Gonorrhœa

Nothing can be more variable than the period at which the disease makes its appearance after infection. Perhaps, at a medium, we may place it between the 4th and 14th day: but in some cases it happens within 24 hours; and in others, not before the end of five or even six weeks: neither of these extremes, however, are common.

From what has been said of the manner in which the contagious matter in gonorrhœa acts, and of the influence it exerts on those parts with which it comes in contact, it follows, that the prevention of gonorrhœa must depend on the removal of the contagious matter as soon as that can be done; and where this is either altogether neglected or not properly accomplished, that the cure must depend on counteracting the inflammation which this contagious matter excities, and the consequences which result from it.

The first of these intentions may be most certainly and most easily accomplished by careful lotion of all the parts to which the contagious matter has any chance of being applied. These parts, at least on the first application of the matter, are readily accessible: for even in men there is no reason to believe that it at first penetrates to any extent in the urethra. This washing of the parts should be performed as soon as possible; because then the matter is both most accessible and least involved with mucus; but although washing cannot be accomplished at an early period, it should not be neglected afterwards; for from the disease uniformly commencing, even when it does not appear till a considerable time after the application of the contagious matter, with a peculiar sense of titillation at the external parts, particularly in men at the extremity of the urethra, there is reason to believe that the contagious matter attached to the mucus may remain latent there for a very considerable time. For the purpose of washing, with a view to the prevention of this disease, recourse may be had to almost any watery fluid, provided it be not so stimulant as to produce bad effects from injuring the parts. Pure water, properly applied, is perhaps one of the best lotions; but there can be no doubt that its power in removing the contagious matter may be somewhat increased by such additions as render it a more powerful solvent of mucus. With this intention, one of the most powerful additions is the vegetable alkali, either in its mild or caustic state. In the latter state it is the most active, but in the former it is most safe; and the *lixiva purificata* of the Edinburgh pharmacopœia, to the extent of half a drachm, dissolved in six or eight ounces of water, is one of the best lotions that can be employed. The purpose of removing the contagion may often also be effectually answered from washing with water impregnated with soap; for there the alkali, though in a caustic state, is prevented from exerting any disagreeable effects, in consequence of its being combined with oily matters.

With the view of preventing gonorrhœa, some have advised, that the alkali either in its mild or caustic state, properly diluted with water, should be injected into the urethra: and there can be no doubt, that by this

this means the contagious matter, when it has entered the urethra, may be removed. A removal may alſo be effected by the injection of a weak ſolution of corroſive ſublimate, which ſeems to act not by diſſolving the mucus but by producing an augmented ſecretion. But at a very early period of the diſeaſe, injections are probably unneceſſary; and if it has made any conſiderable progreſs, they are dangerous: for from the augmented ſenſibility of the part, even very gentle ones are apt to excite a high degree of inflammation.

There are practitioners who, ſuppoſing that the body poſſeſſes powers to expel the virus, and that the diſeaſe has a certain period to run through its ſeveral ſtages of progreſs, acme, and decline, are for leaving the cure to nature; or at leaſt content themſelves with aſſiſting her by an antiphlogiſtic regimen, gentle evacuations, and the like.

That in many caſes the diſorder admits of a natural cure, there can be no doubt; the increaſed ſecretion of mucus carrying off the virus faſter than it is formed, till at length the infection is wholly removed: But it is equally certain, that it every caſe, by the application of ſuitable remedies to the inflamed part, we may ſhorten the duration of the complaint, and abridge the ſufferings of the patient, with the ſame certainty and ſafety as we are enabled to remove the effects of an ophthalmia or any other local inflammation, by proper topical applications. General remedies, ſuch as occaſional blood-letting, a cooling diet, the liberal uſe of diluting liquors, and mild purges, are by all allowed to be uſeful, and even neceſſary. Aſtruc was of opinion that in theſe caſes blood-letting ought to be repeated five or ſix times; and there are ſtill many practitioners who depend much on repeated evacuations of this ſort for a removal of the inflammation. But there is, perhaps, not one caſe in ten in which it is at all requiſite; and this ſmall number of caſes will conſiſt only of the ſtrong and plethoric in ſuch, when the chordee is frequent and painful, and the pulſe hard and full, the loſs of from eight to twelve ounces of blood will be beneficial, but it will be ſeldom neceſſary to repeat the operation the inflammation in theſe caſes is kept up by the local ſtimulus of the virus and the urine; and all that we can expect from veneſection is to moderate the pain and the frequency of erection. In perſons of a delicate habit, and of an irritable fibre, the evacuation will do no good; but if repeated will certainly be liable to do harm, by increaſing irritability, and of courſe rendering the patient more ſuſceptible of ſtimulus.

The utility, and even the neceſſity, of a cooling regimen, are ſufficiently obvious; wine and ſpirituous liquors, ſpiceries, a fiſh-diet, much animal-food, and ſalted and high ſeaſoned diſhes of every ſort, will conſtantly add to the complaint. The patient ſhould eat meat only once a-day, and that ſparingly. He ſhould abſtain from hot-ſuppers. Milk, mild vegetables, and fruit, ſhould conſtitute the principal part of his diet while the inflammatory ſymptoms continue. Every thing that tends to excite the venereal imagination ſhould be ſtudiouſly avoided; for whatever promotes erections of the penis will increaſe the inflammation, and of courſe add fuel to the diſeaſe. For the ſame reaſons much walking or riding on horſeback will be hurtful, from the irritation kept up in the perinæum by ſuch means. Violent excerciſe of any kind, or any thing that is liable to increaſe the heat and the momentum of the blood, will of courſe be improper.

The drinking freely of mild, cooling, mucilaginous liquors, ſuch as linſeed-tea, orgeat, whey, milk and water, almond emulſion, and the like, will be extremely, uſeful, by diluting the urine, and preventing its ſalts from ſtimulating the urethra. When the heat and pain in making water are very conſiderable, mucilaginous ſubſtances are found to have the beſt effect, particularly the gum tragacanth. It is a common practice to give equal doſes of this gum or gum arabic and nitre, and to diſſolve nitre in the patient's drink, with a view to leſſen the inflammation. But in theſe caſes nitre is always improper: it is known to be a powerful diuretic, its chief action being upon the urinary paſſages; ſo that the ſtimulus it occaſions will only ſerve to increaſe the evil it is intended to alleviate. Cream of tartar, on account of its diuretic quality, will be equally improper. Our view here is not to promote a preternatural flow of urine; for the virus, being inſoluble in water, cannot eaſily be waſhed away by ſuch means; but our object ought to be, to render the urine that is ſecreted as mild and as little ſtimulating as poſſible.

Mild purges, which conſtitute another material part of the general remedies, are no doubt extremely uſeful when exhibited with prudence; but it is well known that the abuſe of purgative medicines in this diſeaſe has been productive of numerous evils. Formerly it was a pretty general practice to give a large doſe of calomel at bed-time, three or four times a-week; and to work it off the next morning with a ſtrong doſe of the *pilulæ cocciæ*, or ſome other draſtic purge. This method was perſevered in for ſeveral weeks: in conſequence of which the patient often found himſelf troubled with an obſtinate gleet, and perhaps his conſtitution materially injured; the effect of ſuch a method being (eſpecially in irritable habits) to weaken the ſtomach and bowels, and lay the foundation of hypochondriacal complaints. Violent purging likewiſe often occaſions ſtrangury, hernia humoralis, and other troubleſome ſymptoms.

The purges employed in theſe caſes ſhould be gentle; ſuch as Rochelle ſalt, manna, tartariſed alkali, and the like. They ſhould be given only in a doſe ſufficient to procure two or three ſtools, and be repeated only every two or three days. The daily uſe of the purgative electuaries that are ſtill given by ſome practitioners, ſerves only to keep up a continual irritation on the bladder, and of courſe to prolong the inflammation.

The topical remedies that are uſed conſiſt chiefly of different ſorts of injections, the ingredients of which are extremely various; but their modes of operation may in general be referred to their mucilaginous and ſedative, or to their detergent, ſtimulating, and aſtringent qualities. In the hands of ſkilful practitioners, great advantages may doubtleſs be derrived from the uſe of theſe remedies; but, on the other hand, the improper and unſeaſonable adminiſtration of them may prove a ſource of irreparable miſchief to the patient.

We know that mucilaginous and oily injections will tend to allay the local inflammation; and that a ſeda-

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tive injection, such as a solution of opium, will lessen the irritability of the parts, and of course produce a similar effect; the utility of such applications is therefore sufficiently obvious.

A detergent injection, or one that will act upon the mucus of the urethra, increase the discharge of it, wash it away, and with it the venereal virus that is blended with it, can only be used as a prophylactic before the symptoms of infection have made their appearance. But great circumspection is necessary in the use of this kind of injection. It it be too weak, it can be of no efficacy; and if it be too strong, it may prove dangerous to the patient. A suppression of urine has been brought on by the improper use of an injection of this kind. When the symptoms of inflammation have once made their appearance, the stimulus of such an injection must be extremely hazardous. Excoriation of the urethra has but too often been produced by remedies of this sort in the hands of adventurous and unskilful practitioners.

While the inflammation of the urethra continues, every thing that stimulates it must be hurtful. If the injection excites a painful sensation in the urethra, as is but too often the case, it will be liable to produce swelled testicles, difficulty in making water, excoriation, and other effects of increased inflammation: if, by its astringency, the running be checked before the virus that excited the discharge be properly subdued, the patient will be exposed to fresh dangers; and perhaps to a variety of local complaints, such as obstructions in the urethra, and abscesses *in perinæo*, which are well known to be sometimes owing to applications of this sort improperly managed.

When the inflammation has subsided, gently stimulating and astringent injections may be used with safety, and with considerable advantage: for as the inflammation is at first excited by the stimulus of the venereal virus, so when the former begins to lessen, we may be assured that the activity of the latter has abated in proportion; and, in general, when the inflammatory symptoms are entirely removed, it will be found that the mucus is no longer of an infectious nature but is merely the effect of an increased secretion and of relaxation. Mild-astringents will therefore serve to brace and strengthen the vessels secreting mucus, and in this way will lessen the discharge, and greatly promote the cure. It is certain, that in the greater number of cases, a gonorrhœa, which if treated by internal remedies alone, would continue for five or six weeks, or longer, may, when judiciously treated with injections, be cured in a fortnight, and very often in less time. The great aim, therefore, of the practitioner ought to be at first to make use of such injections only as will tend to lubricate the surface of the urethra, and to counteract and destroy the stimulus of the virus: as the inflammation abates, he may add some gently astringent preparation to a mucilaginous and sedative injection; taking care that its astringency be suited to the state of the disease, and to the irritability of the patient. Amongst a great variety of substances, mercury in different forms is one of those that is the most frequently employed in injections. All these mercurial injections have more or less of astringency; and according to Dr Simmons, it is solely to this property that we are to ascribe their effects; for the idea of their correcting the venereal virus was originally introduced, and has, he thinks, been continued upon mistaken principles.

Gonorrhœa

Calomel, mixed with the mucus discharged in a gonorrhœa, has no more power in destroying the infectious properties of that mucus than cerusse or any other preparation would have. A diluted solution of sublimate injected into the urethra, will like a solution of verdigrise, or blue vitriol, or any other styptic, constringe the mouths of the lacunæ; but this is all that it will do, for it will never lessen the infectious nature of the virus. The same thing may be observed of crude mercury extinguished by means of mucilage, or of mercurial unction, blended with the yolk of an egg, and which, when thrown up into the urethra, will act nearly in the same manner as balsam of copaiva, or any other stimulating injection. The stimulus of calomel, however, has often been found of considerable efficacy; and in women, when the vagina, only was affected, after washing the parts well, the cure has been accomplished by rubbing them repeatedly with mercurial ointment.

As the gonorrhœa is only a local affection, it may be inferred, that the internal use of mercury is unnecessary towards the cure. Very often indeed this complaint may be removed without having recourse to mercurials. Sometimes patients have been met with whose general health has been greatly impaired by a long continued use of mercury in such cases, while the original disease, the gonorrhœa, was rendered much worse by it. In some it degenerated into a gleet, that was cured with extreme difficulty; in others it brought on a variety of distressing symptoms. In cases of gonorrhœas, therefore, whenever mercury is administered, it ought to be, not with a view to expedite the cure, but merely to obviate the dangers of syphilis. When the infection is apparently slight, and the inflammation and the symptoms trifling, we may proceed without the assistance of mercury, especially if the patient be of a weak relaxed, and irritable habit, likely to be injured by mercurial medicines. On the other hand, when the discharge is violent, the inflammation considerable, or the seat of the disease high up in the urethra, it is perhaps the most prudent plan to give mercurials in small doses, and in such forms as seem the best adapted to the constitution of the patient.

The *pilulæ hydrargyri*, as prepared according to the receipts inserted in the last edition either of the London or Edinburgh pharmacopœias, in both of which the mercury is rendered active merely by triture, may perhaps be considered as one of the mildest and most efficacious forms under which mercury can be exhibited by the mouth. Its efficacy will depend on its not irritating the bowels, and so passing off by stool; care must likewise be taken to prevent its affecting the mouth. Of the chemical preparations of mercury, the mildest and least irritating is calomel. It may be given from gr. iß. to gr. iii. at bed-time, occasionally interposing a mild purgative to prevent it from salivating; but in general the mercurial pill just mentioned is to be preferred.

When there is no chancre or bubo, no appearance in short of syphilitic infection, it would be improper to

Apocenoses to adminiſter corroſive ſublimate, the mercurius calcinatus, or any other of the more acrid preparations of mercury.

After a gonorrhœa proceeding from venereal cauſes has been removed, another kind of running without pain, called the *gonorrhœa mucoſa*, or *gleet*, ſometimes remains. Sometimes it ariſes from a conſtriction and excoriation of the urethra, and frequently it is the effect of an enlargement and diſeaſed ſtate of the proſtate. In each of theſe caſes, as the gleet is the effect of irritation, the cure will depend on the removal of the local diſeaſe that occaſions it. But there is another ſpecies of gleet that ſeems to depend chiefly on relaxation. It is in general free from infection, and is moſt common in thoſe who have had long and frequent gonorrhœas. It is likewiſe often the effect of a debilitated habit, from ſevere purging, or a long continued uſe of mercurials. A diſcharge of this kind is more frequent in women than in men; or, at leaſt, the fluor albus, after a gonorrhœa, will often be miſtaken for a gleet.

When there is no reaſon to ſuſpect remaining contagion, aſtringent injections will be of the greateſt ſervice. It will be neceſſary, at the ſame time, to attend to the health of the patient, by employing the Peruvian bark, chalybeate waters, cold bathing, and ſuch other remedies as will tend to ſtrengthen the ſyſtem: and indeed by the uſe of theſe, particularly by the Peruvian bark, ſuch runnings are often ſucceſsfully combated in thoſe who from apprehenſion of dangerous conſequences cannot be prevailed upon to employ injections. When there is no tendency to inflammation, the balſam of copaiva may be preſcribed with advantage in large doſes. Dr Simmons ſays he once ſaw a complaint of this ſort removed by applying a bliſter to the perinæum, after it had reſiſted a variety of other remedies. In the Medical Obſervations alſo we have an account of a gleet and incontinence of urine removed at once by a bliſter to the os ſacrum. In general, however, the other methods abovementioned will be ſufficient to remove it, though ſometimes it will continue for a long time in ſpite of all our endeavours to check it.—Other kinds of gonorrhœa, in which the ſemen itſelf is ejected, eſpecially during ſleep, may be cured by tonics and a mild cooling regimen.

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393 GENUS CXXII. OBSTIPATIO.
COSTIVENESS.

Obſtipatio, *Lin.* 166. *Vog.* 128. *Sag.* 221.

Coſtiveneſs is ſometimes occaſioned by debility in dyſpeptic perſons, ſometimes it is the effect of rigidity, and ſometimes it is ſymptomatic of the colic. It may proceed from an exceſſive heat of the liver; drinking rough red wines, or other aſtringent liquors; too much exerciſe, eſpecially on horſeback: it may likewiſe proceed from a long uſe of cold inſipid food, which does not ſufficiently ſtimulate the inteſtines. Sometimes it is owing to the bile not deſcending to the inteſtines, as in the jaundice; and at other times it proceeds from diſeaſes of the inteſtines themſelves, as a palſy, ſpaſms, tumors, a cold dry ſtate of the inteſtines, &c. Obſtipatio.

Exceſſive coſtiveneſs is apt to occaſion pains of the head, vomiting, colics, and other complaints of the bowels. It is peculiarly hurtful to hypochondriac and hyſteric perſons, as it generates wind and other diſtreſſing ſymptoms.

Perſons who are generally coſtive ſhould live upon a moiſtening and laxative diet; as roaſted or boiled apples, pears, ſtewed prunes, raiſins, gruels with currants, butter, honey, ſugar, and ſuch like. Broths with ſpinage, leeks, and other ſoft pot-herbs, are likewiſe proper. Rye-bread, or that which is made of a mixture of wheat and rye together, ought to be eat. No perſon troubled with coſtiveneſs ſhould eat white bread alone, eſpecially that which is made of fine flour. The beſt bread for keeping the belly ſoluble is what in ſome parts of England they call *meſlin*. It is made of a mixture of wheat and rye, and is very agreeable to thoſe who are acuſtomed to it.

Coſtiveneſs is increaſed by keeping the body too warm, and by every thing that promotes the perſpiration; as wearing flannel, lying too long a-bed, &c. Intenſe thought and a ſedentary life, are likewiſe hurtful. All the ſecretions and excretions are promoted by moderate exerciſe without doors, and by a gay, cheerful, ſprightly temper of mind.

The drink ſhould be of an opening quality. All ardent ſpirits, auſtere and aſtringent wines, as port, claret, &c. ought to be avoided. Malt liquor that is fine and of a moderate ſtrength is very proper. Buttermilk, whey, and other watery liquors, are likewiſe proper, and may be drank in turns, as the patient's inclination directs.

Thoſe who are troubled with coſtiveneſs ought, if poſſible, to remedy it by diet, as the conſtant uſe of medicines for that purpoſe is attended with many inconveniences, and often with bad conſequences. In time the cuſtom becomes neceſſary, and generally ends in a total relaxation of the bowels, indigeſtion, loſs of appetite, waſting of the ſtrength, and death.

The learned Dr Arbuthnot adviſes thoſe who are troubled with coſtiveneſs to uſe animal-oils, as freſh-butter, cream, marrow, fat broths, &c. He likewiſe recommends the expreſſed oils of mild vegetables, as olives, almonds, piſtaches, and the fruits themſelves; all oily and mild fruits, as figs; decoctions of mealy vegetables; theſe lubricate the inteſtines; ſome ſaponaceous ſubſtances which ſtimulate gently, as honey, hydromel, or boiled honey and water, unrefined ſugar, &c.

The doctor obſerves, that ſuch lenitive ſubſtances are proper for perſons of dry atrabilarian conſtitutions, who are ſubject to aſtriction of the belly and the piles, and will operate when ſtronger medicinal ſubſtances are ſometimes ineffectual; but that ſuch lenitive diet hurts thoſe whoſe bowels are weak and lax. He likewiſe obſerves, that all watery ſubſtances are lenitive; and that even common water, whey, ſour milk, and buttermilk, have that effect:—That new milk, eſpecially aſſes milk, ſtimulates ſtill more when it ſours on the ſtomach; and that whey, turned ſour, will purge ſtrongly:—That moſt part of fruits are likewiſe laxative; and that ſome of them, as grapes, will throw

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such as take them immoderately, into a cholera morbus, or incurable diarrhœa.

When the body cannot be kept open without medicine, gentle doses of rhubarb may be taken twice or thrice a-week. This is not near so injurious to the stomach as aloes, jalap, or the other drastic purgatives so much in use. Infusions of sena and mana may likewise be taken, or half an ounce of tartarised alkali dissolved in water-gruel. About the size of a nutmeg of lenitive electuary taken twice or thrice a-day, generally answers the purpose very well.

394 GENUS CXXIII. ISCHURIA.
SUPPRESSION of *Urine*.

Ischuria, *Sauv.* gen. 293. *Lin.* 167. *Vog.* 129. *Sag* 212. *Home*'s Clinical Experiments, sect. xv.

This distemper is distinguished into various species, according as the seat of it is in the kidneys, the ureters, the bladder, or the urethra; and hence these species are named *renalis*, *ureterica*, *vesicalis*, and *urethralis*.

395 1. *Ischuria renalis*, or a suppression of urine from an affection of the kidneys, happens but rarely; however, Dr Home in his Clinical experiments describes such a case. In the end of December 1774, a man of a full habit, aged 35, was seized with shivering, coldness, and severe cough. Three days after, his urine appeared high-coloured, was passed with pain, and in small quantity. About the 8th of January 1775, he was attacked with violent pains in the small of his back, over the whole abdomen, and in the ankles, with pain in the region of the liver when pressed. A general swelling was afterwards observed all over the body, but mostly in the ankles and abdomen, which last was tense and hard. These were attended with vomiting, bad appetite, and considerable thirst. When he entered the clinical ward (Janury 21st), the cough, sickness, and vomiting, had gone off, but the suppression of urine remained. The little which he made was passed with his stools, so that Dr Home saw it but once; and then it was pale, and had a white powder at bottom. The pains and swellings, which retained the impression of the finger, continued; he had a head-ach, and a very slow pulse, beating only 48 strokes in a minute. He had taken a great many diuretic medicines before he came in. The day after his reception, he was seized with a spontaneous diarrhœa, which continued during the remainder of his life. Crystals of tartar were exhibited in doses of half an ounce each morning; at bed-time he took 20 drops of tincture of opium with a scruple of nitre, and continued this course for eight days without any increase of urine. The stronger and heating diuretics were then tried, as an infusion of juniper berries and pills of garlic; but they were attended with no sensible advantage. Whenever the pulse became so strong that he could bear bleeding, eight ounces of blood were taken away, which was sizy. This was thrice repeated; he appeared easier after each bleeding, his pulse bore it well, and the swellings and other symptoms abated. The heating diuretics, in this state, were given up; and a mixture of vinegar and nitre was substituted in their place, in each dose of which, taken every two hours, there was a scruple of nitre. Fomentations were applied to the region of the kidneys, and camphorated oil was afterwards rubbed on the part. He was ordered the semicupium, which from a deficiency of water in the hospital at that time he got only once; and which then seemed to have a good effect, as he passed a gill of urine when he was in it. Notwithstanding this, however, the disease continually gained ground; he became comatose, delirious, and died ten days after his admission.---On dissection, the kidneys were found of an irregular form; some watery vesicles appeared on their surface, containing black gritty particles like fine sand; and the lower part of the right kidney was considerably inflamed. The pylorus, part of the duodenum, and a considerable part of the small intestines, were much inflamed. In the abdomen were found about five pounds of fluid, and in the cavities of the thorax about half a pound.

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The lungs were a little inflamed, and full of small tubercles on their surface and in their substance; the heart was large, and a polypus in each ventricle. About six ounces of fluid were found in the pericardium: in the brain nothing preternatural appeared, except about an ounce of water in each ventricle.

Dr Home seems to have been at a loss for the remote cause of this suppression of urine, which manifestly had its immediate origin from the kidneys having lost the power of performing their functions. He thinks the inflammation which appeared in the right kidney was scarce sufficient to have occasioned the distemper, as the other would have supplied its place: for which reason also he thinks that the ischuria was owing to a general affection of the system; and that it was of an arthritic nature, the patient having been troubled with complaints of that kind for a long time before

2. The *ischuria ureterica* is also a rare disease, unless 396
the obstruction proceeds from a stone or clot of blood stopping up the passage. Gravel or stones, indeed, are very frequently formed in the kidneys; and, by falling into the ureters, occasion an ischuria, with violent pain, and symptoms more or less urgent in proportion to the size and shape of the stones. Sometimes it is attended with coldness of the extremities, nausea, vomiting, and spastic constriction of the præcordia, a difficulty of making water, constipation of the belly, difficulty of breathing, stupor of the thigh, retraction of the testicle to the *os pubis*, inquietude, loss of strength, syncope, and convulsive fits. When
the violent pain has continued for several days and nights without intermission, and has brought the patient exceeding low, and the suppression of urine is complete, with coldness of the extremities and convulsions of the tendons, death is at hand. Nor is it a good sign when the stone continues long in the ureter; for then the appetite decays, a nausea and retching to vomit supervene, and the patient is consumed with a hectic heat. Sometimes the pain is attended with an inflammation of the stomach and intestines; and sometimes the disease ends in a dropsy of the breast, or lethargy, which soon carry off the patient.

The indications of cure are, to exclude the stone as easily as possible, and prevent the breeding of others. If the patient be of a sanguineous temperament, Sydenham recommends to take away ten ounces of blood from

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from the affected side; and then to give the patient a gallon of posset-drink in which two ounces of marsh-mallow roots have been boiled, injecting at the same time an emollient glyster. After the posset-drink has been vomited up, and the clyster returned, give a pretty large dose of an opiate. But if the patient be old or weak, or subject to nervous affections, bleeding may be omitted, especially if his urine at the beginning of the fit be coffee-coloured, and mixed with gravel; but as to other things, the cure is the same.—Huxham greatly recommends an emollient bath prepared of a decoction of marsh-mallow root, linseed, fœnugreek seed, and flowers of chamomile, to which may be added a few white-poppy seeds. By the use of this bath he says he has seen the most cruel fit of the gravel suddenly ended, when neither copious bleeding nor opiates had the least effect. Mild diuretics are also of service. Hoffman recommends dulcified spirit of nitre as proper to relax the spastic stricture. It is to be taken with suitable distilled waters and syrup of poppies; or in broth, with a few spoonfuls of oil of sweet almonds. Turpentine glysters are also accounted very serviceable; and may be prepared of ten ounces decoction of chamomile, with half an ounce of turpentine dissolved in the yolk of an egg, and about as much honey. The *sal diureticus*, or acetated alkali, is much esteemed by some, when taken along with an opiate. But when the stone is too big to pass, Arbuthnot recommends a cool and diluent diet to hinder the further growth of it. Whey, infusion of linseed, decoction of marshmallows, and gently resolving diuretics, are also proper. To put a stop to the vomiting, *balsamum traumaticum* may be used with success when almost every other means have failed.

397 3. The *ischuria vesicalis* may arise from a stone in the bladder; and this indeed is the most common cause of it; but there are certain cases in which, though the usual quantity of urine, or perhaps more, be passed, the patient dies from the retention of a still greater quantity in the bladder. Of this Dr Home gives the following instances. A man of 58 years of age, of a strong spare habit, and never subject to the gravel, had, during the winter of 1777, a cough with expectoration, which went off in the beginning of 1778. About the 17th of February 1778 he felt some difficulty in passing his urine, and much pain about the region of the bladder. He continued in this way for ten days, after which he became easier on application of some medicines. The abdomen then swelled, and he had pains in his loins and thighs. On the 3d of March he was admitted into the clinical ward: his abdomen was then swelled and tense; and an evident fluctuation was felt, which some that touched him thought was sonorous and produced by wind. A tumor was discovered betwixt the navel and spine of the os ilium on the left side, which gave him much pain, especially when pressed. This tumor became more easily felt after the swelling of the abdomen decreased, seemed round, and very near as large as the head of a child. It appeared very much on the left side, even when the patient lay on the right, and the tumor then became dependent. He passed urine frequently, and rather more than in health, as it was computed at four pints a-day. It was always clear, and of a light colour. His body had a strong disagreeable smell; his skin was dry, belly bound, and his appetite entirely gone, so that he had hardly taken any food for 12 days. His legs swelled slightly for some days in the evening. His pulse was generally regular, sometimes slower than natural, and sometimes a little quicker; being once felt at 64, and another time at 92. He was often seized, especially after eating or drinking, with hiccough; which increased and lasted till his death. On the 20th day of his disease, after some doses of squills, the general swelling of his abdomen fell, became much softer, and more distinctly discovered the swelling of the left side. The next day a vomiting came on; he became delirious, and died the day following. The body being opened, it appeared that the tumor which was so distinctly felt on the left side of the abdomen, was owing to a distension of the bladder with urine. Its fundus reached to about the division of the aorta into the iliacs; it entirely filled the pelvis, and contained between five and six pounds of urine of a pale colour. On examining the external surface, its neck, and the beginning of the urethra, were found to be surrounded with a scirrhosity, which impeded the evacuation of the urine. The bladder itself was much thickened, but not more in one part than another. The ureters entered naturally; but were much thickened in their upper half near the kidney. The kidneys were somewhat enlarged; particularly the left, which had several watery vesicles on its external surface. These organs were not in their usual situation; but lay close on each side of the spine, and very near the aorta; so that the renal vessels were very short. What was very singular, the lower end of each rose over the spine, and they were united together by their membranes and substances, the aorta passing beneath the union. The bladder had pressed considerably on this part; and the peritoneum covering them was cosiderably thicker than natural. The lungs adhered every where to the pleura, and in some places very firmly; they were of a loose texture and black colour; and the veins of the lower extremities were turgid with blood. It does not appear that this patient got any medicines further than a few dried squills, which diminished the swellings and brought off much wind. He also got a mixture of musk, and afterwards of opium, for his hiccough; but without success. His disease was mistaken for an ascites; and the catheter was not tried: but in another case the use of this instrument was apparently of more service than any internal medicines. This last patient was about 90 years of age, and laboured under symptoms very similar to those already mentioned. When admitted into the clinical ward, he had the hypogastric region swelled, and difficulty of passing his water; but without pain, vomiting, or hiccough. He had lost all appetite; was thirsty, and costive. His pulse was 110, and weak. In the evening about three English pints of pale clear urine were drawn off by means of the catheter: the next day all the symptoms were gone off or abated. After this he continued to pass some urine, sometimes voluntarily, sometimes involuntarily and insensibly; but so much always remained behind, that his bladder was constantly full, unless when the urine was drawn off,

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Epischeses off, which was done twice every day. The urine was sometimes pale, sometimes of a deep red colour; and once there was some blood mixed with it, which perhaps might have been occasioned by the catheter. About the sixth day the urine was very putrid, with much purulent-like matter at the bottom, and was passed with more pain. About the 11th, the putrid smell went off. The next day all the urine passed insensibly except what was drawn off; and an hiccough, though not very severe, had come on. In this way he continued without fever, though frequently troubled with the hiccough, especially during those nights in which the urine had not been drawn off. A month after admittance, the bladder, with the assistance of the catheter, was almost entirely, though insensibly evacuated, and the hiccough had left him; he had no other complaint but that of voiding his urine insensibly, the natural effect of a scirrhous bladder, and which was probably incurable. With this patient the hot bath and mercurials were tried, in order to soften the scirrhosity of the bladder, but without effect.

398 4. The *ischuria urethralis* arises from some tumour stopping up the passage of the urethra, and thus hindering the flow of urine. It is an uncommon distemper, and generally follows a gonorrhœa. Dr Home gives us an example of this also.—The patient was a man of 60 years of age, who had laboured under a gonorrhœa six months before, and which was stopped by some medicines in two or three days. He felt, soon afterwards, a difficulty in passing his urine, which gradually increased. About 10 days before his admission into the clinical ward, it was attended with pains in the glans, and *ardor urinæ;* he had passed only about eight ounces the day before his admission, and that with very great difficulty; and the hypogastric region was swelled and pained. On introducing the catheter, three pounds of urine were drawn off, by which the pain and swelling were removed. The instrument required force to make it pass the neck of the bladder, and blood followed the operation; and the finger, introduced into the anus, felt a hard tumor about its neck. He was treated with mercurial pills and ointment, by which the swelling about the neck of the bladder soon began to decrease; but at the same time a swelling of the right testicle appeared. He was vomited with four grains of turbith-mineral, which operated gently; and here Dr Home observes, that though these vomits are little used, from a mistaken notion of their severity, he never saw them operate with more violence than other vomits, or than he could have wished. The swelling diminished in consequence of the vomit and some external applications: and the cure was completed by bleeding and a decoction of mezereon-root.

399 GENUS CXXIV. DYSURIA.

DIFFICULTY OF DISCHARGING URINE.

Dysuria, *Sauv.* gen. 265. Lin. 57. *Vog.* 164 *Sag.* 213.
Stranguria *auctorum.*

A difficulty of making water may arise from many different causes; as some from acrid matter in the blood, cantharides, for instance: and hence a strangury very often succeeds the application of blisters. Dysuria. In many cases it arises from a compression of some of the neighbouring parts; of the uterus, for instance, in a state of pregnancy. Or it may arise from a spasmodic affection of the bladder, or rather its sphincter; or from an inflammation of these parts, or others near them. Hence the disease is distinguished into so many species, the cure of which depends upon the remedies indicated by their different causes.

But the most common, as well as the most dangerous species is that arising from a calculous concretion, or

STONE in the BLADDER. 400

Dysuria calculosa, *Sauv.* sp. 12.

The signs of a stone in the bladder are, pain, especially about the sphincter; and bloody urine, in consequence of riding or being jolted in a carriage; a sense of weight in the *perinæum;* an itchness of the *glans penis;* slimy sediment in the urine; and frequent stoppages in making water; a *tenesmus* also comes on while the urine is discharged: but the most certain sign is, when the stone is felt by the finger introduced into the anus, or by the catheter.

Causes, &c. It is not easy to say what the particular causes are that occasion the apparently earthy particles of the fluids to run together, and form those calculous concretions which are found in different parts of the body, and especially in the organs for straining off and discharging the urine.

The gout and stone are generally supposed to have some affinity, because gouty people are for the most part afflicted with the gravel. But perhaps this is in part owing to their long confinement, and to the lying on the back, which people who labour under the gout are often obliged to submit to; since the want of exercise, and this posture, will naturaly favour the stagnation of gross matters in the kidneys: besides, there are many instances of people severely afflicted with the stone for the greatest part of a long life, who have never had the least attack of the gout.

There is, however, good reason for believing, that some farther connection takes place between the two diseases; and when treating of the gout we have already given some account of the opinion of an ingenious anonymous author, who has endeavoured to prove, that both the one and the other depend on a peculiar acid, the concreting or lithic acid, which is always present in blood; and which may be precipitated from thence by various causes, such as the introduction of other acids, or the like. When thus precipitated, he supposes it to produce the whole phenomena of both diseases. The objections we formerly stated to his theory of gout, do not equally militate against that of calculus; and it is at least certain, from the best chemical analysis, that what are commonly called *urinary calculi*, and have been considered as entirely an earthy matter, consist principally of acid in a solid state united only with a small proportion of earth or mucus. We may, therefore, whether this hypothesis be altogether well founded or not, justly view lithiasis as depending on the separation of an acid from the blood.

Whatever may be the particular cause of the disposition

Epischesis. position to *lithiasis*, the kidneys appear to be the most likely places for particles to concrete or run together, because of the great quantity of blood which passes through the renal arteries, and which comes immediately from the heart, fraught with various newly-received matters, that have not undergone much of the action of the vessels, and therefore cannot as yet be supposed to be thoroughly assimilated.

Anatomists who have carefully examined the kidneys in the human subject, particularly M. Bertin, inform us, that there are two sets of *tubuli uriniferi*; the one continued directly from the extremities of the renal artery, and the other springing from that vesicular texture which is conspicuous in the kidneys.

It is in this vesicular part of the kidney that we presume the particles of the concreting matter first stagnate and coalesce: for it is hardly to be supposed, that such solid matters could be allowed to stop in the extremities of the renal arteries, since the blood, and the urine separated from it, must flow through these vessels with great degrees of force and velocity; but in the intermediate vesiculæ the particles may lie, and there attracting each other, soon come to acquire sensible degrees of magnitude, and thus become sand or gravel. As long as this sand or gravel formed in the vesicular part of the kidney lies quiet, there will be no pain or uneasiness, until the concretions become large enough to press either on the adjoining *tubuli*, or on the blood-vessels; then a sense of weight, and a kind of obtuse pain in the loins, will be felt. But when the small pieces of concreting matter shall be dislodged and washed off by the force of the circulating fluids, or loosened by some spasmodic action of the moving fibres in these parts, they will in their passage create pain, raise different degrees of inflammation, or perhaps lacerate some blood-vessels, and cause bloody urine. When these little concretions happen to be detained in the pelvis of the kidney, or any other place where a flow of urine continually passes, they soon increase in size, and become calculi, from the constant accession of particles, which are attracted by the original bit of sand, which thus become the nucleus of a stone.

It is an opinion which Hippocrates first advanced, and which has been almost universally adopted by his followers, and has remained till lately uncontroverted, that the stone and gravel are generated by the use of hard water. And from this quality, which the waters of certain springs possess, of depositing a large earthy sediment, either in the aquæducts thro' which they are conveyed, or in the vessels in which they are boiled or preserved, it was conjectured, that in passing through the kidneys, and especially whilst retained in the bladder, they would let fall their grosser particles, which by the continued apposition of fresh matter, connected by the animal gluten, and compacted by the muscular action of that organ, would in time form a calculus sufficiently large to produce a train of the most excruciating symptoms. And this reasoning *à priori* has been supposed to be confirmed by facts and experience; for not to mention the authority of Hippocrates, Dr Lister has observed, that the inhabitants of Paris are peculiarly subject to the stone in the bladder. Nicholas de Blegny has related the history of one who was dissected at Paris, in whom the pylorus, a great part of the duodenum, and the stomach itself, were found incrustated with a stony matter, to the thickness of a finger's breadth. And it is well known, that the water of the river Seine, with which that city is supplied, is so impregnated with calcareous matter, as to incrustate, and in a short time to choak up, the pipes through which it runs. But on the other hand it is objected, that the human calculus is of animal origin, and by chemical analysis appears to bear very little analogy to the stony concretions of water; and though it be allowed, that more persons are cut for the stone in the hospitals at Paris than in most other places; yet upon inquiry it is found, that many of those patients come from different provinces, and from towns and villages far distant from the Seine.

Dr Percival conjectures, that though this disease may chiefly depend upon a peculiar disposition to concrete in the animal fluids, which in many instances is hereditary, and in no instance can with certainty be imputed to any particular cause; yet hard water is at least negatively favourable to this diathesis, by having no tendency to diminish it. The urine of the most healthy person is generally loaded with an apparently terreous matter, capable in favourable circumstances of forming a calculus; as is evident from the thick crust which it deposits on the sides of the vessels in which it is contained. And it seems as if nature intended by this excretion to discharge all the superfluous salts of the blood, together with those earthy particles, which are either derived from our aliment, and fine enough to pass thro' the lacteals, though insuperable by the powers of circulation, or which arise from the abrasion of the solids, or from the dissolution of the red globular part of our fluids. Now water, whether used as nature presents us with it, or mixed with wine, or taken under the form of beer or ale, is the great diluter, vehicle, and menstruum, both of our food, and of the saline, earthy, and excrementitious parts of the animal juices. And it is more or less adapted to the performance of these offices, in proportion to its degree of purity. For it must appear evident to the most ordinary understanding, that a menstruum already loaded, and perhaps saturated with different contents, cannot act so powerfully as one which is free from all sensible impregnation. Nor is this reasoning founded upon theory alone; for it is observed, that Malvern water, which issues from a spring in Worcestershire remarkable for its uncommon purity, has the property of dissolving the little sabulous stones which are often voided in nephritic complaints. And the solution too, which is a proof of its being complete, is perfectly colourless. Hence this water is drunk with great advantage in disorders of the urinary passages. And during the use of it the patient's urine is generally limpid, and seldom deposits any sandy sediment. Yet notwithstanding this appearance of transparency, it is certainly at such times loaded with impurities, which are so diluted and dissolved as not to be visible. For it is attended with a strong and fetid smell, exactly resembling that of asparagus. Hoffman mentions a pure, light, simple water in the principality of Henneberg, in Germany, which is remarkable for its efficacy in the stone and gravel; and a water of similar virtues was discovered not many years ago

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ago in the black forest, near Osterod, which upon examination did not afford a single grain of mineral matter. Indeed it is worthy of observation, that most of the springs which were formerly held in great esteem, and were called *holy wells*, are very pure, and yield little or no sediment.

Dr Percival informs us that a gentleman of Manchester, who had been long subject to nephritic complaints, and often voided small stones, was advised to refrain from his own pump-water, which is uncommonly hard, and to drink constantly the soft water of a neighbouring spring; and that this change alone, without the use of any medicine, has rendered the returns of his disorder much less frequent and painful. A lady also, much affected with the gravel, was induced by the perusal of the first edition of Dr Percival's Essay, to try the effect of soft water; and by the constant use of it remained two years entirely free from her disorder.

In nephritic cases, distilled water would be an excellent substitute for Malvern water, as the following experiment evinces.

Two fragments of the same calculus nearly of equal weight, were immersed, the one in three ounces of distilled water, the other in three ounces of hard pump-water. The phials were hung up close together in a kitchen-chimney, at a convenient distance from the fire. After 14 days maceration, the calculi were taken out, and carefully dried by a very gentle heat. The former, *viz.* that which had been immersed in distilled water, was diminished in its weight a grain and a half; the latter had lost only half a grain.

It is the passage of these calculi from the kidneys down into the bladder, which occasions the pain, vomiting, and other symptoms, that constitute what is usually termed a *fit of the gravel* or *stone*.

When an inflammation is actually raised, the disease is known by the name of *nephritis*, and has been already treated of.

As soon as the stone passes through the ureter, and falls into the bladder, the pain and other nephritic symptoms cease; and every thing will remain quiet, either till the stone be carried into the urethra, or until it has remained long enough in the bladder to acquire weight sufficient to create new distress.

If a stone happens to be smooth and of a roundish form, it may lie in the bladder and acquire considerable bulk before it can be perceived by the patient; but when it is angular, or has a rugged surface, even though it may be small in size, yet it seldom fails to raise pain, and occasion bloody urine, or the discharge of a slimy fluid, with tenesmus, and difficulty in making water.

There have been various attempts made to dissolve the stone; and there are certainly some articles which have this effect when applied to them out of the body; but the almost total impossibility of getting these conveyed to the kidneys, renders it extremely doubtful whether a solvent ever will be discovered. Of all the articles employed for this purpose, no one perhaps has had greater reputation than fixed alkaline salt in its caustic state, particularly under the form of the *aqua lixivi caustica:* but this being of a very acrid nature, it requires to be well sheathed by means of some gelatinous or mucilaginous vehicle. Veal-broth is as convenient as any for this purpose; and accordingly it is used by those who make a secret of the caustic alkali as a solvent of calculus;

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Mr Blackrie, who has taken much pains in this inquiry, has proved very satisfactorily, that Chittrick's nostrum is no other than soap-lees given in veal-broth, which the patients send every day to the doctor, who returns it mixed up with the medicine, in a close vessel secured by a lock.

It is not every case, however, that either requires or will bear a course of the caustic alkali. Some calculi are of that soft and friable nature, that they will dissolve even in common water; and there are cases wherein it appears that the constant use of some very simple decoction or infusion of an insignificant vegetable, has brought away large quantities of earthy matter, in flakes which apparently have been united together in layers to form a stone. Dr Macbride assures us, that a decoction of raw coffee, only 30 berries in a quart of water, boiled till it acquired a deep greenish colour, taken morning and evening to the quantity of eight or ten ounces, with ten drops of sweet spirit of nitre, had the powerful effect of bringing away, in the course of about two months, as much earthy matter in flakes as filled a large tea-cup. The patient was far advanced in years; and, before he began this decoction, had been reduced to great extremities by the continuance of pain and other distressing symptoms: he was purged occasionally with *oleum ricini.*

Very lately the alkali in a mild state, and in a different form, has been much used by many calculous patients and with great advantage, under the form of what is called *alkaline aërated water*. For the introduction of this medicine, or at least for its extensive use, we are chiefly indebted to that ingenious physician Dr William Falconer of Bath. He has lately published an account of the *Aqua Mephitica Alkalina*, or Solution of fixed alkaline salt, saturated with fixable air, in calculous disorders; which contains a number of cases strongly supporting the benefit to be derived from it. But whether the good effects obtained in these instances are to be explained from its operating as a solvent of calculus, seems to be extremely doubtful. There are indeed cases in Dr Falconer's treatise, of patients in whom, after using it for a considerable time, no stone could be detected by sounding, although it had been discovered in that way before they began the employment of it. But in many instances, the relief has been so sudden, that it may be concluded, that, notwithstanding the ease obtained, the calculus still remained. In such cases, it probably removed from the urine that quality by which it gives to the calculus fresh accretions, producing that roughness of its surface by which it is chiefly capable of acting as a stimulus. For the distressing symptoms resulting from stone, are more immediately to be attributed to the inflammatory and spasmodic affections which it induces; and when its surface is least capable of operating as a stimulus, these of course will be least considerable. It is therefore not improbable, that this remedy produces relief, by preventing fresh additions being made to the calculus.

An infusion of the seeds of *daucus sylvestris* sweetened with honey, is another simple and much celebrated remedy;

Epischeses remedy; it has been found to give considerable ease in cases where the stomach could not bear any thing of an acrid nature: the leaves of the *uva ursi* were strongly recommended by the late very celebrated De Haen; and, whatever its way of operating may be, seems to have been productive of good effects in some instances. There is no reason to believe that it has any influence in dissolving calculus; and indeed it seems to be chiefly useful in these instances where ulcerations take place in the urinary passages.

In the Edinburgh Medical Commentaries, vol. 3. we have an account of a method used by the inhabitants of Arabia Petræa for curing the stone, to which they are very much subject, and which the author (an English gentleman of experience and candour) affirms he has seen frequently performed with never-failing success. By means of a catheter they inject into the bladder a weak ley of alkali with the purified fat of a sheep's tail, and a proper quantity of opium all put together. Their catheters are made of gold; and in performing the operation they introduce them quite into the bladder; so that the composition is safely conveyed to the stone without hurting any other part. But when a stone is situated in the kidney, they have no method of cure.

If this method of curing by injection could be safely practised, it would no doubt greatly have the advantage over that of taking alkalies by the mouth, where the medicine is not only much weakened, but the constitution of the patient runs the risk of being greatly injured. But from some experiments mentioned in the second volume of the Medical Transactions, it appears that the human calculi are very different from one another in their natures. Some, for instance, will easily yield to an alkaline menstruum, and very little to an acid; while others are found to resist the alkali, and yield to the acid; and some are of such a compact nature, that they yield neither to acids nor alkalies. An attention, however, to the fragments, scales, or films, which the stone may cast off, and also to the contents and sediment of the urine, may lead to the discovery of what solvent is proper, or whether the stone can be dissolved by any. To use either alkalies or acids improperly may be hurtful; though there may be such kinds of calculi as demand the alternate use of acids and alkalies; nay, there may be found calculi of opposite kinds in the same subject.

In such cases as will not allow us to think of dissolving the stony concretions, and where the only scheme is to palliate and procure ease from time to time, little more can be done than to keep the bowels open occasionally by some gentle cathartic, and wash off as much of the loose gravelly matter and slime as can be removed by such mild diuretic infusions and decoctions as shall be found to pass freely and sit well on the stomach. Persons afflicted with the stone should be careful in respect of their diet, and studiously avoid all heavy and flatulent food, as well as high sauces that are apt to turn rancid. For the same reason, butter and acids are to be shunned; for these often create heart-burning, and every thing that offends the stomach raises the nephritic pain; such is the sympathy that obtains between the digestive and the uropoietic organs.

There have been surgeons bold enough to entertain an idea of cutting even into the kidney, in order to extract a stone: this, however, except in cases where an abscess has been formed, and nature points out the way is merely chimerical. But cutting into the bladder for the same purpose, is an ancient and well-known operation, and often crowned with success. A description, however, of this operation belongs to the article SURGERY, to which we refer; and here shall only make this remark, that a surgeon should never begin his operation, until he and his assistants are perfectly satisfied, from actually feeling the stone, that there is one in the bladder; because it has sometimes happened, that when the incision has been made, no stone could be found: and the patient having died in consequence of the operation, and the body being opened, it has appeared that the symptoms which occasioned the belief of a stone in the bladder arose from some other cause. Dysuria.

WHEN a dysuria proceeds from any acrimonious matter thrown into the blood, it may be readily cured by bleeding, emollient clysters, cooling and diluting drinks with gum arabic or gum tragacanth, linseed tea, or the warm bath. When it arises from inflammations of the bladder or parts adjoining to it, we are to regard it only as a symptomatic affection; and the remedies used to remove the primary disease will also remove the dysuria. Sometimes it may arise from an ulcer of the bladder; in which case it is generally incurable; a mild nutritious diet will, however, protract the patient's life.

GENUS CXXV. DYSPERMATISMUS. 401
Difficult EMISSION *of* SEMEN.

Dyspermatismus, *Sauv.* gen. 260.
Sterilitas, *Lin.* 171. *Sag.* 211.
Agenesia, *Vog.* 283.

This impediment proceeds generally from obstructions in the urethra, either by tumors in itself, or in the cavernous bodies of the penis; in which case the treatment is the same as in the ischuria urethralis; sometimes it is owing to a kind of epileptic fit which seizes the man in the venereal act; and sometimes the semen, when ejected from the proper receptacles, is again absorbed by them, or flows into the bladder and is expelled along with the urine. The last case is very difficult, or indeed impossible to cure; as proceeding from scirrhi, or other indissoluble tumors of the verumontanum, or the neighbouring parts. In some it proceeds merely from too violent an erection: in which case emollient and relaxing medicines will be of service; and we have an example of a cure performed by means of these in the first volume of the Edinburgh Medical Essays.

GENUS CXXVI. AMENHORRHOEA. 402
SUPPRESSION *of the* MENSES.

Amenorrhœa, *Vog.* 130.
Dysmenorrhœa, *Lin.* 168. *Sag.* 218.

This, with some other symptoms, as dyspepsia, yellowish or greenish colour of the skin, unusual appetites, &c. constitutes the *chlorosis* already treated of, and which seldom or never appears without a suppression of the menses. In Dr Home's Clinical Experiments

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ments we find the virtues of several emmenagogues set forth in the following manner. Chalybeates seldom or never succeeded: they were always found more useful in diminishing the evacuation when too violent, than in restoring it when deficient. The tincture of black hellebore proved successful only in one of nine or ten cases, though given to the length of four tea-spoonfuls a-day, which is double the quantity recommended by Dr Mead. Compression of the crural artery, recommended by Dr Hamilton in the Physical and Literary Essays, Vol II. proved successful only in one of six cases. From the effects produced by this compression, it has the strongest appearance of loading the uterus with blood; from the sensations of the patient it produces the same effects as the approach of the menses, and has every appearance in its favour; yet does not succeed. Dr Home supposes that the uterus is more frequently in too plethoric and inflammatory a state; in which case, this remedy will do more hurt than in a state of inanition; however, he owns, that in the case in which it did succeed, the patient was plethoric and inflammatory. Venesection is recommended as an excellent remedy; the Doctor gives three instances of its success, and says he could give many more. It acts by removing the plethoric state of the uterus, relaxing the fibres, and giving the vessels full play; so that their action overcomes all resistance, and the evacuation takes place. It is of no great moment from whence the blood is taken; the saphænic vein will perhaps empty the uterus most; but it is difficult to get the proper quantity from it, and the quantity of the discharge cannot be so well measured. The powder of savine is a most powerful remedy; and proved successful in three cases out of four in which it was tried. It was given to the quantity of half a drachm twice a-day. It is a strong topical stimulus, and seems improper in plethoric habits. Madder-root, according to Dr Home, is a very powerful medicine in this disease; and proved successful in 14 out of 19 cases in which it was tried, being sometimes exhibited in the quantity of two scruples, or a drachm, four times a-day. It has scarce any sensible effects; never quickens the pulse, or excites inflammatory symptoms: on the contrary, the heat, thirst, and other complaints abate; and sometimes these symptoms are removed, though the disease be not cured; but when it succeeds, the menses appear from the third to the 12th day.—For other methods of curing the amenorrhœa, see CHLOROSIS. Amenorrhœa.

WE have now considered all those diseases enumerated in Dr Cullen's Nosology, whose cure is to be attempted chiefly by internal medicines. The other genera either require particular manual operations, or a very considerable use of external applications; and therefore properly fall under the article SURGERY. To this, therefore, we shall refer the genera which fall under the three last orders of this class of locales, viz, the *tumores*, *ectopiæ*, and *dialyses*; and we shall add, by way of Appendix, a few observations on some important affections to which Dr Cullen has not given a place in his system.

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ANGINA PECTORIS.

DR HEBERDEN was the first who described this disease, though it is extremely dangerous, and, by his account not very rare. It seizes those who are subject to it when they are walking, and particularly when they walk soon after eating, with a most disagreeable and painful sensation in the breast, which seems to threaten immediate destruction: but the moment they stand still, all the uneasiness vanishes. In all other respects the patients at the beginning of this disorder are well, and have no shortness of breath; from which the *angina pectoris* is totally different. After it has continued some months, the fits will not cease instantaneously on standing still; and it will come on not only when the patients are walking, but when they are lying down, and oblige them to rise up out of their beds every night for many months together. In one or two very inveterate cases, it has been brought on by the motion of a horse or carriage, and even by swallowing, coughing, going to stool, speaking, or by any disturbance of mind. The persons affected were all men, almost all of whom were above 50 years of age, and most of them with a short neck and inclining to be fat. Something like it however, was observed in one woman, who was paralytic; and one or two young men complained of it in a slight degree. Other practitioners have observed it in very young persons.

When a fit of this sort comes on by walking, its duration is very short, as it goes off almost immediately upon stopping. If it comes on in the night, it will last an hour or two. Dr Heberden met with one in whom it once continued for several days; during all which time the patient seemed to be in imminent danger of death. Most of those attacked with the distemper died suddenly: though this rule was not without exceptions; and Dr Heberden observed one who sunk under a lingering illness of a different nature.

The *os sterni* is usually pointed to as the seat of this malady; but it seems as if it was under the lower part of that bone, and at other times under the middle or upper part, but always inclining more to the left side; and in many cases there is joined with it a pain about the middle of the left arm, which appears to be seated in the biceps muscle.

The appearance of Dr Heberden's paper in the Medical Transactions very soon raised the attention of the faculty, and produced other observations from physicians of eminence; namely, Dr Fothergill, Dr Wall of Worcester. Dr Haygarth of Chester, and Dr Percival of Manchester. It also induced an unknown sufferer under the disease to write Dr Heberden a very sensible letter, describing his feelings in the most natural manner; which, unfortunately, in three weeks after the date of this anonymous epistle, terminated in a sudden death, as the writer himself had apprehended.

The youngest subject that Dr Fothergill ever saw afflicted

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afflicted with this disorder was about 30 years of age; and this person was cured. The method that succeeded with him was a course of pills, composed of the mass of gum pill, soap, and native cinnabar; with a light chalybeate bitter: this was continued for some months, after which he went to Bath several successive seasons, and acquired his usual health: he was ordered to be very sparing in his diet; to keep the bowels open; and to use moderate exercise on horseback, but not to take long or fatiguing walks.

The only symptom in this patient that is mentioned, was a stricture about the chest, which came on if he was walking up hill or a little faster than ordinary, or if he was riding a very brisk trot; for moderate exercise of any kind did not affect him: and this uneasy sensation always obliged him to stop, as he felt himself threatened with immediate death if he had been obliged to go forward.

It is the sharp constrictive pain across the chest, that (according to Dr Fothergill's observation) particularly marks this singular disease; and which is apt to supervene upon a certain degree of muscular motion, or whatever agitates the nervous system.

In such cases as fell under the inspection of Dr Fothergill, he very seldom met with one that was not attended with an irregular and intermitting pulse; not only during the exacerbations, but often when the patient was free from pain and at rest: but Dr Heberden observes, that the pulse is, at least sometimes, not disturbed; and mentions his having once had an opportunity of being convinced of this circumstance, by feeling the pulse during the paroxysm.

But no doubt these varieties, as well as many other little circumstances, will occur in this disease as they do in every other, on account of the diversity of the human frame; and if those which in general are found to predominate and give the distinguishing character be present, they will always authorise us in giving the name to the disease: thus, when we find the constrictory pain across the chest, accompanied with a sense of strangling or suffocation; and still more, if this pain should strike across the breast into one or both arms; we should not hesitate to pronounce the case an *angina pectoris*.

As to the nature of this disease, it appears to be purely spasmodic: and this opinion will readily present itself to any one who considers the sudden manner of its coming on and going off; the long intervals of perfect ease; the relief afforded by wine, and spirituous cordials; the influence which passionate affections of the mind have over it; the ease which comes from varying the posture of the head and shoulders, or from remaining quite motionless; the number of years for which it will continue, without otherwise disordering health; its bearing so well the motion of a horse or carriage, which circumstance often distinguishes spasmodic pains from those which arise from ulcers; and lastly, its coming on for the most part after a full meal, and in certain patients at night, just after the first sleep, at which time the incubus, convulsive asthma, and other ills, justly attributed to the disordered functions of the nerves, are peculiarly apt to return or to be aggravated.

From all these circumstances taken together, there can be little doubt that this affection is of a spasmodic nature: but though it should be admitted, that the whole distress in these cases arise from spasm, it may not be so easy to ascertain the particular muscles which are thus affected.

The violent sense of strangling or choaking, which shows the circulation through the lungs to be interrupted during the height of the paroxysm; and the peculiar constrictive pain under the sternum, always inclining (according to Dr Heberden's observation) to the left-side; together with that most distressing and alarming sensation, which, if it were to increase or continue, threatens an immediate extinction of life; might authorise us to conclude that the heart itself is the muscle affected: the only objection to this idea, and, if it had been constantly observed, it would be insurmountable, is, that the pulse is not always interrupted during the paroxysm. The appearances in two of the dissections, favour the opinion that the spasm affects the heart; as in one subject the left ventricle (and, though it be not mentioned, we may presume the right one also) was found as empty of blood as if it had been washed; and in another, the substance of the heart appeared whitish, not unlike a ligament; as it should seem, in both cases, from the vessels and force of the spasms squeezing the blood out from the cavities.

If this hypothesis be allowed, we must conclude that the spasm can only take place in an inferior degree, as long as the patient continues to survive the paroxysm; since an affection of this sort, and in this part, of any considerable duration or violence, must inevitably prove fatal: and accordingly, as far as could be traced, the persons who have been known to labour under this disease have in general died suddenly.

The dissections also show, that whatever may be the true seat of the spasm, it is not necessary for the bringing of it on, that the heart, or its immediate appendages, should be in a morbid state; for in three out of the six that have as yet been made public, these parts were found in a sound state.

On opening the body of the poor gentleman who wrote the letter to Dr Heberden, "upon the most careful examination, no manifest cause of his death could be discovered; the heart, in particular, with its vessels and valves, were all found in a natural condition."

In the case communicated by Dr Percival to the publishers of the Edinburgh Medical Commentaries, "the heart and aorta descendens were found in a sound state."

And in Dr Haygarth's patient, "on opening the thorax, the lungs, pericardium, and heart, appeared perfectly sound." Not to mention Dr Fothergill's patient (R. M.), in whose body the only morbid appearance about the heart was a small white spot near the apex. So that the cause, whatever its nature might have been, was at too great a distance, or of too subtile a nature, to come under the inspection of the anatomist. But there was a circumstance in two of the subjects that is worthy of remembrance; and which shows that the crasis of the blood, while they were living, must have been greatly injured, namely, its not coagulating, but remaining of a cream-like consistence, without any separation into serum and crassamentum.

From all that we have seen hitherto published, it

Angina Pectoris.

does not appear that any considerable advances have been made towards the actual cure of this anomalous spasm.

The very judicious and attentive Dr Heberden (to whom the public are highly indebted for first making the disorder known) confesses, that bleeding, vomits, and other evacuations, have not appeared to do any good: wine and cordials, taken at bed-time, will sometimes prevent or weaken the fits; but nothing does this so effectually as opiates: in short, the medicines usually called *nervous* or *cordial*, such as relieve and quiet convulsive motions, and invigorate the languishing principle of life, are what he recommends.

Dr Wall mentions one patient, out of the 12 or 13 that he had seen, who applied to him early in the disease, and was relieved considerably by the use of antimonial medicines joined with the fetid gums: he was still living at the time the Doctor wrote his paper, (November 1772), and going about with tolerable ease. Two were carried off by other disorders; all the rest died suddenly.

Dr Fothergill's directions are chiefly calculated with the view to prevent the disorder from gaining ground, and to alleviate present distress. Accordingly he enjoins such a kind of diet as may be most likely to prevent irritability: in particular, not to eat voraciously: to be particularly abstemious in respect to every thing heating; spices, spirits, wines, and all fermented liquors: to guard most scrupulously against passion, or any vehement emotions; and to make use of all the usual means of establishing and preserving general health: to mitigate excesses of irritability by anodynes; or pains, if they quicken the circulation: to disperse flatulencies when they distend the stomach, by moderate doses of carminatives; amongst which, perhaps, simple peppermint water may be reckoned one of the safest. But since obesity is justly considered as a principal predisposing cause, he insists strongly on the necessity of preventing an increase of fat, by a vegetable diet, and using every other practicable method of augmenting the thinner secretions.

These were the only means which occurred to the English physicians of opposing this formidable disease: but Dr Smyth of Ireland has, we are told, discovered that it may be certainly cured by issues, of which Dr Macbride gives the following instance.

"*A. B.* a tall, well made man: rather large than otherwise; of healthy parents, except that there had been a little gout in the family; temperate; being very attentive to the business of his trade (that of a watch-maker), led a life uncommonly sedentary; had, from his boyhood upwards, been remarkably subject to alarming inflammations of this throat, which seized him, at least, once in course of the year; in all other respects well.

"In 1767, (then 48 years of age), he was taken, without any evident cause, with a sudden and very dispiriting throbbing under the sternum. It soon afterwards increased, and returned upon him every third or fourth week, accompanied with great anxiety, very laborious breathing, choaking, a sensation of fulness and distention in the head, a bloated and flushed countenance, turgid and watery eyes, and a very irregular and unequal pulse. The paroxysm invaded, almost constantly, while he was sitting after dinner; now and then he was seized with it in the morning, when walking a little faster than usual; and was then obliged to stop, and rest on any object at hand. Once or twice it came on in bed; but did not oblige him to sit up, as it was then attended with no great difficulty in breathing. In the afternoon fits his greatest ease was from a supine posture; in which he used to continue motionless for some hours, until, quite spent and worn out with anguish, he dropt into a slumber. In the intervals between these attacks, which at length grew so frequent as to return every fourth or fifth day, he was, to appearance, in perfect health.

"Thus matters continued for more than two years; and various antispasmodics were ineffectually tried for his relief. In 1769, there supervened a very sharp constrictory pain at the upper part of the sternum, stretching equally on each side, attended with the former symptoms of anxiety, dyspnœa, choaking, &c. and with an excruciating cramp, as he called it, that could be covered with a crown-piece, in each of his arms, between the elbow and the wrist, exactly at the insertion of the pronater teres; the rest of the limb was quite free. The fits were sometimes brought on, and always exasperated, by any agitation of mind or body. He once attempted to ride on horseback during the paroxysm; but the experiment was near proving fatal to him. The difference of season or weather made no impression upon him. Still, in the intervals, his health was perfectly good; except that his eyes, which before his illness were remarkably strong and clear, were now grown extremely tender; and that his sight was much impaired. He had no flatulency of stomach, and his bowels were regular.

"In this situation, February 22. 1770, he applied to me for assistance. I had seen, I believe, eight or ten of these frightful cases before. Two of the patients dropt dead suddenly. They were men between 40 and 50 years of age, and of a make somewhat fleshy. The fate of the others I was not informed of; or, at least, cannot now recollect.

"Having found the total inefficacy of blisters and the whole class of nervous medicines in the treatment of this anomalous spasm, I thought it right to attempt the correcting or draining off of the irritating fluid in the case now before us. To this purpose, I ordered a mixture of lime-water with a little of the compound juniper-water, and an alterative proportion of Huxham's antimonial wine: I put the patient on a plain, light, perspirable diet; and restrained him from all viscid, flatulent, and acrimonious articles. By pursuing this course, he was soon apparently mended; but after he had persisted regularly in it for at least two months, he kept for some time at a stand. I then ordered a large issue to be opened on each of his thighs. Only one was made. However, as soon as it began to discharge, his amendment manifestly increased. The frequency and severity of the fits abated considerably; and he continued improving gradually, until, at the end of 18 months he was restored to perfect health; which he has enjoyed, without the least interruption, till now, except when he has been tempted (perhaps once in a twelvemonth) to transgress rules, by making a large meal on salted meat, or indulging himself in ale or rum-punch, each of which never failed to disorder

Angina Pectoris.

order him from the beginning of his illness: and even on these occasions he has felt no more than the slightest motion of his former sufferings; insomuch that he would despise the attack, if it did not appear to be of the same stock with his old complaint. No other cause has had the least ill effect on him.

"Though rum was constantly hurtful, yet punch made with a maceration of black currants in our vulgar corn-spirit, is a liquor that agrees remarkably well with him.

"He never took any medicine after the issue began to discharge; and I have directed that it shall be kept open as long as he lives. The inflammations of his throat have disappeared for five years past; he has recovered the strength and clearness of his sight; and his health seems now to be entirely re-established."

Dr Macbride, in a letter to Dr Duncan, published in the Edinburgh Medical Commentaries, gives the following additional observations on this disease.

"Within these few weeks I have, at the desire of Dr Smyth, visited, three or four times, a very ingenious man who keeps an academy in this city, of about 34 years of age, who applied to the Doctor for his advice in January last.

"I shall give you his symptoms as I had them from his own mouth, which appear to me to mark his case to be an angina pectoris, and as deplorable as any that I have read of. It was strongly distinguished by the exquisite constrictory pain of the sternum, extending to each of his arms as far as the insertion of the deltoid muscle, extreme anxiety, laborious breathing, strangling, and violent palpitation of the heart, with a most irregular pulse. The paroxysms were so frequent, that he scarcely ever escaped a day, for six or seven years, without one. They were usually excited by any agitation of mind or body, though slight. He had clear intervals of health between the fits. The distemper seems hereditary in him, as he says his father was affected in the same manner some years previous to his death. He has a strong gouty taint, which never showed itself in his limbs; and he has led a life of uncommon sedentariness, from intense application to mathematical studies, attention of mind, and passion, even from his boyish years. These circumstances may, perhaps, account for his having been taken with this disease at so early an age as 17.

"A large issue was immediately opened in each of his thighs. In a month afterwards he began to mend, and has gone on improving gradually. He can now run up stairs briskly, as I saw him do no later than yesterday, without hurt: can bear agitation of mind; and has no complaint, excepting a slight oppression of the breast, under the sternum, which he feels sometimes in a morning, immediately after dressing himself, and which he thinks is brought on by the motion used in putting on his clothes; though for a complete week preceding the day on which I saw him last, he told me that he had been entirely free from all uneasiness, and was exulting that he had not had such an interval of ease for these last seven years.

"Doctor Smyth also showed me, in his *adversaria* the case of a gentleman who had been under his care in 1760, which he had forgotten when my book went to the press, and which he was reminded of the other day by a visit from his patient. It was a genuine angina pectoris, brought on by a very sedentary life, and great vexation of mind, clearly marked by the exquisite pain under the sternum, that extended acutely to the upper extremities, particularly along the left arm, together with the other symptoms of dyspnœa, anxiety, palpitation of the heart, &c. recited in the case above. The disorder went off in 1762, by large spontaneous discharges from the piles, but returned upon him severely in 1765. Issues in his thighs were then recommended to him, but not made. But, whether it was by the persuasion of some friend, or of his own accord, he went into a course of James's powder, in small alterative doses, combined with a little castor and asafœtida. This he persisted in for about six weeks; in the meanwhile, he had large acrimonious gleetings from the scrotum, and a plentiful discharge of ichor from the anus.—From this time he began to find his complaints grow less and less distressing, and he has now been totally free from them for six years past."

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This species of fever, as its name imports, is peculiar to women in child-bed; and is usually the most fatal of all the disorders to which the sex is liable. But, notwithstanding the prevalence of it in all ages, its real nature has remained, to the present time, a subject of much dispute and uncertainty. The critical period of its invasion, when febrile commotions are apt to be excited by various accidents, and equivocal symptoms which accompany it, have even afforded room for questioning whether it be a primary or a secondary disease. Some writers have considered it as proceeding entirely from an inflammaion, of the uterus; others have imagined it to be the consequence of an obstruction to the secretion of the milk; while the greater number has been inclined, for reasons equally if not more plausible, to impute it to a suppression of the lochia. If we examine this fever attentively, however according to its natural course, and independently of all the accidental concomitant symptoms with which it is not essentially connected, we may safely pronounce it to be a primary disease of a particular characteristic, and perhaps not the necessary consequence of any of the causes abovementioned.

This fever is most generally incident to women within 48 hours after delivery, though it may supervene on the fourth or fifth day, and sometimes considerably later. It is preceded, like other fevers, by a rigor, which is commonly violent; and, when happening during the time of labour, may be confounded with the pains of parturiency. In its earlier stage it is attended with the signs of inflammation. A great pain is felt in the back, hips, and the region of the uterus; which, in the part last mentioned, is accompanied with the sense of heat and throbbing. A sudden change in the quality or quantity of the lochia now also takes place; the patient is frequently troubled with a tenesmus; and the urine, which is very high coloured, is discharged in small quantity and with pain. At the first attack of the fever, the woman is generally seized with a vomitting of porraceous matter, as in the *cholera morbus*, to which disease it then bears a strong resemblance.—But instead of this symptom, there is sometimes only

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a nauſea, or loathing at the ſtomach, with a diſagreeable taſte in the mouth. The belly ſwells to a conſiderable bulk, and becomes ſuſceptible of painful ſenſations from the ſlighteſt impreſſion. The tongue is generally dry, though ſometimes moiſt, and covered with a thick browniſh fur. When the fever has continued a few days, the ſymptoms of inflammation uſually ſubſide, and the diſeaſe acquires a more putrid form. At this period, if not at the very beginning of the diſorder, a bilious or putrid diarrhœa, of a dangerous and obſtinate nature, ſupervenes, and accompanies it through all its future progreſs; each motion to ſtool being preceded by a temporary increaſe, and followed by an alleviation of pain. The patient uſually nauſeates all kind of food and drink, except what is cold and acidulated. A brown or blackiſh ſordes, the conſequence of putrid exhalations, adheres to the edges of the teeth; a troubleſome hiccough is at length produced, which greatly exaſperates the pains of the abdomen; petechiæ or vibices alſo appear, with ſometimes a miliary eruption, but which produces no mitigation of the diſeaſe. Through the whole courſe of the fever the patient is affected with great anxiety and dejection of ſpirits.

Such in general is the courſe of the puerperal fever; the ſymptoms of which, however, may be often varied according to the conſtitution of the patient, the degree of the diſeaſe, and its earlier or later invaſion. When the woman is naturally weak, or her ſtrength has been greatly reduced by immoderate evacuations after delivery; when the diſeaſe is violent, and immediately follows that period; its progreſs and termination are proportionably rapid and fatal. In ſuch unfortunate circumſtances, many have been known to expire within 24 hours from the firſt attack of the diſeaſe; nay, there are ſome inſtances where the rigor has concluded the ſcene. The cataſtrophe, however, is moſt generally ſuſpended for ſome days; and the number of theſe is variable, though the 11th from commencement of the fever may juſtly be fixed as the period which is uſually deciſive. In whatever ſtage of the diſeaſe an unfavourable termination may happen, it would ſeem as if the commencement of the patient's recovery were not marked by any critical revolution of the fever, as depending on an alteration of the humors; but that the cure is gradually effected, either by a ſpontaneous vomiting, or a long-continued diſcharge by ſtool of that porraceous matter, the exiſtence of which in the ſtomach is uſually evinced at the firſt attack of the diſeaſe. The moſt unfavourable prognoſtic, therefore, ariſes from ſuch a weakneſs of the patient as renders her unable to ſupport ſo tedious an evacuation as that by which the fever is overcome. When the lochia return to their former ſtate, when the ſwelling and tenderneſs of the abdomen abate, and there is a moiſture on the ſkin, we have reaſon to hope for a happy termination of the diſeaſe.

Though the puerperal fever may generally be aſcertained from the deſcription which has been given, and chiefly by that remarkable tenderneſs of the abdomen; which particularly diſtinguiſhes it; yet, as ſome of its ſymptoms may be confounded with thoſe ariſing from other diſeaſes, and which require a different method of cure, it will be proper to mention here the circumſtances whereby it may be known with greater certainty.

The pains of the abdomen, attending the child-bed fever, may be diſtinguiſhed from thoſe called *after-pains*, by their uninterrupted continuance through the courſe of the diſeaſe, though ſometimes they ſuffer exacerbations; whereas, in the latter, they often totally intermit. They are alſo diſtinguiſhable by the abſence of fever with concomitant ſymptoms in the one, and their evident exiſtence in the other.

Many circumſtances evince a diſſimiliarity between the puerperal and miliary fevers, notwithſtanding the ſymptoms of anxiety and oppreſſion are common to both; inſomuch that the nature of the approaching diſeaſe may be aſcertained at the very commencement of its attack. In the puerperal fever the rigor is more violent, of longer duration, and not interrupted, as in the other. The pulſe is fuller and ſtronger; the ſkin is more hot; and the tongue, whether moiſt or dry, though generally the latter, is not of a white, but browniſh appearance; and the urine is alſo higher coloured. Eruptions, which are critical in miliary fevers, procure no mitigation of the puerperal fever, and cordials generally increaſe it.

When the original attack of the puerperal fever happens to coincide with the febrile commotion which is excited in child-bed women by the milk, the nature of it may at firſt be miſapprehended; but the concomitant ſymptoms, and greater violence of the diſeaſe, muſt in a ſhort time diſſipate ſuch an error.

From all the moſt accurate accounts of this diſeaſe, and from the period at which it generally commences, there ſeems reaſon to conclude, that it owes its riſe more immediately to accidents after delivery. For it is allowed that it may follow a labour under the beſt and moſt favourable circumſtances, though endeavours to dilate the os internum are ſuppoſed frequently to produce it. The more immediate cauſes generally aſſigned by authors are a ſtoppage of perſpiration, the too free uſe of ſpices, and the neglect of procuring ſtools after delivery; ſudden frights, too haſty a ſeparation of the placenta, and binding the abdomen too tight. The putrid appearance, however; which this diſeaſe ſo ſoon aſſumes, affords ground to ſuſpect that the prediſpoſing cauſe of it is a vitiated ſtate of the humors; for it is generally obſerved to be moſt prevalent in an unhealthy ſeaſon, and among women of a weakly and ſcorbutic conſtitution.

Within theſe few years this fever has been treated of by ſeveral writers, moſt of whom have differed from each other in their ſentiments of the nature of the diſeaſe. The firſt in the order of publication is Dr Denman, who ſeems to be of opinion, that it may derive its origin either from a redundancy or too great acrimony of the bile, the ſecretion of which appears to be much interrupted in the time of geſtation. In Dr Manning's treatiſe on this fever, he mentions its being highly probable that ſuch a cauſe contributes greatly to produce the diſeaſe, eſpecially where the putrid tendency of the humors is increaſed by unwholeſome air and diet.

It has likewiſe been the fate of the puerperal fever, that no diſeaſe has more divided the ſentiments of phyſicians in regard to the method of cure. The apparent

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rent indications and contra-indications of bleeding, and other remedies, arising from the complication of inflammatory and putrid symptoms; the equivocal appearance of the vomiting and purging, as whether they be critical or symptomatical; and the different causes whence symptoms similar to each other may arise in pregnant women; all these circumstances concur to involve the subject in great obscurity and indecision. If we carefully attend to the several characteristics of the disease, however, so as to be able to distinguish it from every other puerperal complaint, and observe at the same time the usual manner of its declension, our judgement may be guided in the method of cure by the salutary efforts of nature. But, in order to obtain a clearer view of the genuine indications, it will be proper to consider them under the several lights in which they have been generally agitated by authors.

One of the most essential points to be ascertained in the cure of the child-bed fever, respects the propriety of bleeding. A free use of the lancet has been generally regarded as the most successful expedient in practice; and there are some instances of critical hæmorrhagies which would seem to confirm its utility. But Dr Denman thinks we may safely affirm from experience, that for one who will be benifited by large bleeding, a much greater number will be injured, and that even almost irretrievably. Nor can this seem surprising, when we consider the situation of child-bed women. In most, the evacuations consequent upon delivery are sufficient to diminish any undue superabundance of the fluids; and if, as frequently happens, the disease be produced by too hasty a separation of the placenta, the consequence of which is generally a very copious discharge of blood, we can never suppose that nature will be assisted in overcoming the febrile commotion, by the farther evacuation of the vital fluid, through the defect of which she is now rendered unequal even to the ordinary support of the animal œconomy. We may appeal to every practical physician, how much he has known the pulse to sink, and what a train of nervous symptoms he has observed to succeed an excess of the discharge abovementioned. Besides, it is an axiom in physic, that a remedy which cures any disorder, will always prove sufficient to prevent it; and therefore, if bleeding were the proper cure in the child-bed fever, the disease ought to have been prevented by a large evacuation of blood, when that happened previous to its seizure. Experience, however, in this, as in all other diseases, is the only unerring guide we can follow; and whoever regulates his practice by fact and observation, will be convinced that bleeding, especially in a larger quantity, is, in general, very far from being attended with success. Bleeding is seldom proper, except in women of plethoric constitutions, and in whom the signs of inflammation rise high. Nor even in such patients ought it to be repeated without great caution, and the existence of strong indications. Bleeding, when used in proper circumstances, may unquestionably palliate the fever; but that it often shortens the duration of it, appears to be a matter of much doubt. On this account the practice becomes still more suspicious and exceptionable, when we consider that by venesection improperly used, the person's strength may be so far reduced as not to support the tedious loosenes by which the disease is generally carried off. Though bleeding, however, ought in general to be used with great caution, there are certainly many cases in which it is both necessary and advatageous.

The genuine nature and effects of the loosenes in this disease, is another controverted point of the highest importance, and which merits the most attentive inquiry. Physicians, observing that women who die of the puerperal fever are generally molested with that evacuation, have been induced to consider this symptom as of the most dangerous and fatal tendency; and what, therefore, we should endeavour by every means to restrain. In this opinion, however, they would seem to have been governed by too partial an observation of facts. For experience certainly authorises the assertion, that more women appear to have recovered of the child-bed fever, through the intervention of a diarrhœa, than have been destroyed by that cause. If it also be considered, that purging is usually almost the only sensible evacuation in the more advanced state of the disease, and is that which accompanies it to its latest period, we shall have the strongest reason to think that it is critical rather than symptomatical, and ought therefore to be moderately supported, instead of being unwarily restrained. Nay, the advantage which is found to attend vomiting as well as purging, in the earlier stage of the disease, would seem to evince that the matter discharged by these evacuations is what chiefly foments the disease. Emetics and purgatives, therefore, in the opinion of Dr Manning, are the only medicines on which any rational dependence is to be placed in the fever; at least, they are certainly such as are found the most successful. It is an established rule in practice, to prescribe a vomit at the beginning of every fever attended with any nausea or loathing of the stomach, and where there is not any reason to apprehend an inflammation of that organ. Nor does the state of child-bed women afford the smallest ground for prohibiting our recourse to the same expedient in answering a similar indication.

It is so seldom a physician is called during the rigor preceding the puerperal fever, that he has few opportunities of trying the effects of remedies in that early state of the disease. When such occur, however, we should endeavour as much as possible to abate and shorten that period, as the succeeding fever is generally found to bear a proportion to the violence and duration of it. For this purpose, warm diluting drinks should be plentifully used, with a small quantity of volatile spirits or brandy. When Dr Manning apprehended such an accident, he sometimes ordered the nurse to give immediately a dish or two of warm sack-whey; taking care that it was not too strong, which is a caution that ought always to be remembered: for though a freer use of the more cordial and spirituous kinds of liquors might perhaps soon abate the rigor, there is danger to be feared from their influence on the approaching fever, especially in women of a strong and healthy constitution. In all cases, warm applications to the extremities, such as heated bricks, towels, or toasted grains in a linen bag, may be used with perfect safety, and some advantage.

When the hot fit is advanced, the first thing Dr Manning orders is some emollient injection, as chicken-water,

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water, or water and milk, which ought to be frequently repeated through the course of the disease. These prove beneficial, not only by promoting the discharge from the intestines, which seems in fact to be the solution of the disease; but also by acting as a kindly fomentation to the uterus and adjacent parts. With this intention they are particularly serviceable when the lochia are suppressed. Great care, however, is requisite in administering them, on account of the tenderness and inflammatory disposition, which at that time render the parts in the pelvis extremely susceptible of pain.

The next step in the method of cure ought to be to promote the discharge of the morbid matter both by the stomach and intestines. This intention is best answered by the remedy prescribed by Dr Denman, of which the following is the receipt.

R. Tartar. emetic. gr. ii.
Ocul. cancror. præp. ℈i. Intimè misceantur.

Of a powder thus prepared, Dr Denman gives from two to six grains, and repeats it as circumstances require. If the first dose do not procure any sensible operation, he repeats it in an increased quantity at the end of two hours, and proceeds in that manner; not expecting any benefit but from its sensible evacuation.

Should the disease be abated, but not removed, (which sometimes happens), by the effect of the first dose, the same medicine must be repeated, but in a less quantity, till all danger be over. But if any alarming symptoms remain, he does not hesitate one moment to repeat the powder, in the same quantity as first given; though this be seldom necessary, if the first dose operates properly.

It is to be observed, says Dr Denman, that as the certainty of cure depends upon the proper repetition of the medicine, the method of giving it at stated hours does not appear eligible. If the first dose produce any considerable effect by vomiting, procuring stools, or plentifully sweating, a repetition of the medicine in a less quantity will seldom fail to answer our expectations; but great judgment is required in adapting the quantity first given to the strength of the patient and other circumstances. We are not to expect that a disease which from the first formation carries so evident marks of danger, should instantly cease, even though a great part of the cause be removed.

Frequent doses of the saline draughts ought also to be given, which not only promote the evacuation by the intestines, but likewise increase the salutary discharges of urine and perspiration. These medicines are particularly serviceable in subduing the remains of the fever, after its violence has been broken by the more efficacious remedies abovementioned; but when they are used even in the decline of the disease, gentle laxatives of rhubarb and magnesia, as advised by Dr Denman, ought to be frequently interposed, since, as he justly observes, without stools we can do little service.

Notwithstanding the discharge by the intestines appears to have the most salutary effect in this disease, yet when the stomach has not been properly unloaded of offensive matter, though a great nausea and sickness had indicated the expediency of such an evacuation at the beginning of the fever, the continuance of the looseness is sometimes so long protracted as in the end to prove fatal. In this alarming state of the disease, when the stools are very frequent and involuntary, and all appearances threaten danger, Dr Denman says, that a clyster of chicken-water injected every one, two or three hours, or as often as possible without fatiguing the patient too much, with the following draught taken every six hours, has produced better effects than could be expected.

R. Pulv. rad. ipecacuan. gr. i.
Confect. Damocrat. ℈i.
Aq. alexiter. simp. vel.
Cinnamom. simp. ℥iss. M. f. Haustus.

While these medicines are using, we should endeavour to mitigate the pains of the belly by relaxing applications. During the course of the disease, the patient ought to drink freely of diluting liquors, and abstain from every thing of a heating quality, unless great faintness should indicate the use of a small quantity of some cordial medicine.

Such is the practice recommended in this disease by Dr Denman, We shall now take a cursory view of the sentiments of succeeding writers on this subject.

According to Dr Hulme, the proximate cause of the puerperal fever is an inflammation of the intestines and omentum; for the confirmation of which opinion he appeals to dissections. He supposes the chief predisponent cause of the disease to be the pressure of the gravid uterus against the parts abovementioned. The omentum, says he, in the latter stage of pregnancy, must either be flat, which is its natural situation, or be rumpled or carried up by the gravid uterus in folds or doublings. When the latter is the case, which he observes is probably not seldom, the danger of a strangulated circulation will be greater.

Mr White, who has also written on this disease, judiciously remarks, that were Dr Hulme's hypothesis well founded, the disorder ought rather to take place before delivery, and be immediately removed at that period: That it would likewise most generally happen to women at their first labour, when the abdominal muscles are less yielding, and the pains more violent; the contrary of which is most frequently experienced to be the case.

It also deserves to be remarked, that, upon Dr Hulme's supposition, we cannot account for the disease being more common and fatal in large towns and in hospitals, than in the country and private practice, while other inflammatory disorders are more endemic among those who live in the latter than the former situation. Even admitting the friction of the intestines and omentum against the uterus to be as violent as Dr Hulme supposes, is it not highly improbable, that any inflammation could be occasioned by the pressure of such soft substances upon each other? Or, were this effect really produced, ought not the puerperal fever to be more common and fatal after the most laborious deliveries? But this observation is not supported by experience.

Dr Hulme, in favour of his own hypothesis, alleges that it gives a satisfactory answer to the question, "Why all lying-in women have been, and ever will be, subject to this disease?" In this proposition, however, the Doctor supposes such an universality of the disease as is not confirmed by observation. It is affirmed

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firmed upon undoubted authority, that in many parts of Britain the puerperal fever is hardly known; whereas, were it really produced by the causes he assigns, it would be equally general and unavoidable.

But how peculiar soever this author's sentiments are in respect of the proximate cause of this disease, they have not led him to any method of cure different from the established practice. On this subject Dr Hulme divides his observations into two parts, comprehending under the former the more simple method of treatment, and under the latter the more complex. He set out with remarking, that the patient being generally costive at the beginning of the disease, an emollient opening clyster will often give immediate relief; but if this should not prove effectual, recourse must be had to cathartics. Those which he found answer his pupose best, were the *sal catharticus amarus*, the *oleum ricini*, emetic tartar, and antimonial wine. When the bowels have been sufficiently cleared and the pain abates, he advises encouraging a gentle diaphoresis by medicines which neither bind the body nor are heating; such as a small dose of ipecacuan, emetic tartar, and antimonial wine, combined with an opiate in a moderate dose, and given once or twice in the course of 24 hours; administering the saline draughts in the intermediate spaces. If, preceding or during this course, a sickness at stomach or vomiting attend, he advises assisting the efforts of nature, by drinking plentifully of camomile tea, warm water, or any other diluting liquor. He concludes with recommending a cooling regimen, rest of body, and tranquillity of mind; prohibiting all kinds of bandages upon the abdomen, and enjoining particular attention to the state of the bowels, which ought to be kept gently open for some time, even after the disorder seems to be gone off, till the patient be quite out of danger.

So much for the simple treatment: we now proceed to the second part, where he describes the method of practice when the disease is in its more irregular and complicated state.

When a diarrhœa accompanies the disease, he observes that it ought by no means to be checked, but supported, by ordering the patient to drink plentifully of mild aperient liquors. If the pain of the hypogastric region be attended with stitches in the sides or over the pit of the stomach, and a pulse that resists the finger pretty strongly, he remarks that bleeding would then be highly necessary: declaring, however, his opinion, that in the puerperal fever, bleeding is to be considered only as a secondary means of relief, though the first in point of time; that it ought to be advised with great caution; and that the greatest dependence is always to be placed upon evacuations by stool.

Mr White, abovementioned, imputes the puerperal fever to a putrescent disposition of the humours, contracted during pregnancy, and fomented by the hot regimen commonly used by women in child-bed. In conformity to this opinion, the chief means which he recommends for preventing the disease is a cool regimen and free circulation of air, which he evinces to be of the greatest importance. In respect of bleeding, he informs us, that, upon the strictest inquiry, he cannot find that those who have bled the most copiously have had the greatest success, either in private or hospital practice. He even seems to question the propriety of this evacuation in any case; but approves of emetics, cathartics, and clysters, for cleansing the *primæ viæ*, and likewise of such medicines and diet as will correct the putrid humours: adding, that an upright posture and free ventilation are at all times useful, and absolutely necessary, both for the prevention and cure of the disease.

Another writer who treats of the child-bed fever is Dr Leake, who has published the result of his observations on this disease from April 1768 to the autumn of the year 1770; but chiefly from December 1769 to May 1770, during which period the child-bed fever prevailed much about London.

Dr Leake tells us that this fever generally commenced the evening of the second or morning of the third day after delivery, with a rigor or shivering fit. Sometimes it invaded soon after delivery; and at other times, though rarely, it has seized so late as the fifth or sixth day. Now and then it seemed to be occasioned by catching cold, or by errors in diet; but oftener by anxiety of mind. Sometimes the thirst was great; tho' the tongue had, in general, a better appearance at the beginning than is common in other fevers. It was seldom ever black or very foul; but, as the disease advanced, became white and dry, with an increase of thirst; and at last was of a brownish colour towards the root, where it was slightly covered with an inspissated mucus. The loss of strength was so great and sudden, that few of the patients could turn in bed without assistance, even so early as the first or second day after the attack. The lochia, from first to last, were not obstructed, nor deficient in quantity; neither did the quality of this discharge seem to be in the least altered from its natural state; a presumption, says the author, that the uterus was not at all affected. Of this he was covinced by making a considerable pressure above the pubes with the hand, which did not occasion pain; but when the same degree of pressure was applied higher, between the stomach and umbilical region, it became almost intolerable. A perfect crisis seldom if ever happened in this fever, which he imputes to the great oppression of the vital powers, whereby they were rendered unable to produce such an event. When the disease proved mortal, the patient generally died on the 10th or 11th day from the first attack. In those who died of the fever, the omentum was found suppurated; an inflammation of which part, or of the intestines, Dr Leake concludes to be the proximate cause of the disease.

In consequence of this idea of the cause of the disease, Dr Leake affirms that venesection is the only remedy which can give the patient a chance for life. But, though it be the principal resource to be depended upon at the beginning of the fever, he observes that it will seldom prove of service after the second or third day; and, if directed yet later, will only weaken and exhaust the patient; when, matter having begun to form in the omentum, the progress of the disease can no longer be prevented by that evacuation. At this period the blood begins to be tainted by the absorption of the purulent fluid; and the fever, from being inflammatory, is changed into a putrid nature.

After bleeding in such a quantity as the symptoms require, he advises that the corrupted bile be evacuated and corrected as soon as possible; that the diarrhœa,

Puerperal Fever.

rhœa, when excessive, be restrained by emollient anodyne clysters and gentle sudorifics, or even by opiates and mild astringents, when the patient's strength begins to sink under the discharge; and lastly, that where the signs of the putrefaction or intermission take place, antiseptics and the Peruvian bark may be administered.

The great uniformity of the symptoms in all Dr Leake's patients might authorise an opinion, that the fever which he describes was in a great measure a disease *sui generis*, and depended much upon the constitution of the air preceding and during the period in which the fever prevailed.

Dr Kirkland has also made judicious observations on this subject. He rejects the opinion that the puerperal fever is a disease *sui generis*, and arises always from the same cause. The particular situation of child-bed women, he acknowledges, occasions a similarity in the appearance of all the febrile symptoms: but he affirms that the same kind of fever may be produced by various causes; for instance, by an inflammation of the uterus or abdomen, by putrid blood or other matter, and putrid miasms. The symptoms, he observes, will vary according to the time of seizure. If the fever happens in three or four days after delivery, all the symptoms usual to the situation of the patient will make their appearance; but if it do not invade till the milk has been secreted, and the lochial discharge be nearly finished, the symptoms, if the breasts are properly drawn, will, for the most part, be those only which are common to that kind of disorder by which the fever has been produced.

With respect to the cure of puerperal fevers, Dr Kirkland advises the antiphlogistic method when they arise from inflammation; but when this method fails of success, and a diarrhœa supervenes, the disease has changed its nature, having become more or less putrid, and requires a very different treatment.

His observations relative to the management of the diarrhœa merit attention. No one, says he, would purge and bleed to cure the colliquative fever arising from the absorption of matter in large wounds; and yet the only difference is, that in the puerperal fever the matter absorbed from the uterus, &c. acts with more violence, because the blood is commonly thinner and the habit in a more irritable state. We see, continues he, that absorbed matter purges as effectually as if any purging medicine had been given by the mouth; and may we not therefore do harm by additional purging, when there has been a large evacuation, especially as purges in this case are incapable of entirely removing the *fomes morbi?*

He considers the Peruvian bark as the principal remedy, as soon as the pulse sinks, the heat is lessened, and the stomach will bear it. If the bark increase the diarrhœa beyond moderation, he joins with it small doses of laudanum; but if the diarrhœa should entirely stop without the fever going off, in place of laudanum he advises a proper quantity of rhubarb. Should the diarrhœa, notwithstanding the use of the medicines proposed, become so violent as to endanger the patient, he joins Mr White in recommending the columbo root, which is a warm cordial, and removes the irritability of the stomach and intestines more powerfully than any other bitter he knows.

Of this disease also, as it appeared in Derbyshire and some of the adjacent provinces, an account has been published by Dr Butter. Concerning the causes and nature of the disease, he observes, that pregnancy seems to add much to the natural sensibility of the female constitution; because at this period women are often subject to a train of nervous symptoms, which never molest them at other times. During gestation likewise, the appetite is for the most part keen, while the digestion appears to be impaired; and this weakness is increased not only by improper food, of which the woman is frequently desirous, but also by the inactivity attending her situation. To these circumstances, it is added, that the intestinal passage being interrupted by the uterine pressure, costiveness generally prevails. From the several observations here enumerated, Dr Butter concludes, that the proximate cause of the puerperal fever is a spasmodic affection of the first passages, with a morbid accumulation in their cavity; and upon this supposition he endeavours to account for the various symptoms of the disease.

In treating of the method of cure, he lays down two indications; the former of which is to promote two, three, or four stools daily, in a manner suited to the strength of the patient, till such time as they resume a natural appearance. The second indication is to relieve all uneasy symptoms, such as heat, thirst, head-ach, &c.

With respect to the opinion entertained by Dr Butter of the cause of the puerperal fever, it nearly coincides with that of Mr White. But however plausible it may appear, we are not entirely satisfied that a disease attended with so peculiar symptoms as the puerperal fever can depend principally upon an irritability, which is not restricted either to the pregnant or puerperal state.

The late Dr Thomas Young professor of midwifery in the university of Edinburgh, although he published nothing on the subject of the puerperal fever, wrote a very ingenious dissertation respecting it, which was read in the Philosophical Society of Edinburgh. In that dissertation, after giving a very accurate account of the symptoms of the disease, which coincides very nearly with the account given by others, he endeavours to show, that the *puerperal fever*, strictly so called, is in every instance the consequence of contagion; but he contends, that the contagious matter of this disease is capable only of producing its effect, in consequence of a peculiar predisposition given by delivery and its consequences. In support of this doctrine, he remarks, that for many years the disease was altogether unknown in the lying-in ward of the Royal Infirmary at Edinburgh; but that after it was once accidentally introduced into the hospital, almost every woman was in a short time after delivery attacked with it; although prior to her delivery, she may have lain even for weeks together, not only in the same ward with the infected, but even in the very next bed. He remarks, that it was only eradicated from the hospital in consequence of the wards being entirely emptied, thoroughly ventilated, and new painted. After these processes, puerperal females in the hospital remained as free from this disease as formerly. The puerperal fever, according to Dr Young, has very generally a strong tendency to the typhoid type; although he allows, that in

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in the beginning it is not unfrequently attended with inflammatory ſymptoms, and even with topical inflammation, particularly in the inteſtinal canal. On this idea, he conſiders the puerperal fever as admitting of the ſame variety of treatment with other affections depending on contagion, in which ſometimes an inflammatory, ſometimes a putreſcent tendency, prevails; ſuch, for example, as ſmall-pox or eryſipelas. But from the prevailing putreſcent tendency in this affection, he conſiders the free acceſs of cool air, with the liberal uſe of antiſeptics, as being very generally requiſite.

It deſerves to be remarked, that though the ſeveral writers who treat of this ſubject have conducted their method of cure conformably to their particular idea of the cauſe of the diſeaſe, reſpecting which their ſentiment are very different, they ſeem to have been equally ſucceſsful in the treatment of their patients. Indeed the ſeveral writers differ leſs from each other in their method of cure than might be expected, where ſo great an oppoſition of theoretical ſentiments prevails. For after endeavouring to eſtabliſh indications correſpondent to their particular ſyſtems, thoſe who contend for the expediency of promoting the inteſtinal diſcharge, diſſuade not from a recourſe to phlebotomy when the diſeaſe is attended with inflammatory ſymptoms; while, on the other hand, the moſt ſtrenuous advocates for bleeding admit the utility of the former evacuation. It appears, therefore, that a due regulation of the alvine diſcharge is neceſſary through the whole courſe of the fever, but veneſection only ſometimes.

CEPHALALGIA.
Head-Ach

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The head-ach is ſymptomatic of very many diſtempers, but is rarely an original diſeaſe itſelf. Dr Home acquaints us that his report-books only furniſh four inſtances of it; and of theſe four, three were women. The diſeaſe proved fatal to the man; and after death, a coſiderable effuſion of blood was found on the brain, together with ſome hydatids, and water in the ventricles.

Head-achs appear frequently to be occaſioned by effuſions of blood or ſerum; as well as by ulcers, and abſceſſes of the brain, dura and pia mater. Accretions and oſſifications of different parts of the dura mater, falx, and brain, are alſo frequently diſcovered. An oſſification of the falx, however, does not always produce head-ach: for Dr Home mentions a patient who had the falx oſſified without head-ach; but he had been obſerved to be very furious when drunk. Congeſtions of blood in the veſſels of the brain are alſo diſcovered from diſſections to be a frequent cauſe of the head-ach; and nervous irritation alone will frequently produce it, as we ſee in the *clavus hyſtericus*.

In the cure of this diſeaſe we have little or no power over oſſifications, effuſions, or ulcerations; and hence the head-ach is frequently incurable In congeſtions, and nervous affections, medicines may indeed be of ſome ſervice. Congeſtion may be relieved by an evacuation of blood, either general or topical; as veneſection, cupping, or leeches: by errhines; which, however, Dr Home thinks are little to be depended upon: by topical evacuations near the head by bliſters, iſſues, or ſetons; by purgatives; or by determining the fluids to other parts, by rubefacients applied to the temples, pediluvia, &c.

Cephalalgia.

Nervous irritation may be diminiſhed, 1. By a great quantity of cold water drunk every morning. This is recommended by Hoffman; and will waſh off all acrid particles from the ſtomach, while the cold ſtrengthens and diminiſhes the ſenſibility of the part. This remedy was tried for a conſiderable time in one of Dr Home's patients without any effect. 2. Nervous and tonic medicines; as the bark, valerian, &c These were tried in two of Dr Home's patients, but alſo without ſucceſs. In a third the valerian ſucceeded. 3. By cold water applied to the head, immerſion, or the ſhower-bath. 4. Cephalics; as lavender, roſemary, &c. In ſlight caſes, the ſmell of eau de luce, or any ſtrong volatile alkali, will generally prove a cure.

A *Dangerous* Affection *of the* Œsophagus.

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This diſtemper has only been treated of by Dr Munckley, who reckons it one of the moſt deplorable diſeaſes of the human body. Its beginning is in general ſo ſlight as to be ſcarce worth notice, the patients perceiving only a ſmall impediment to the ſwallowing of ſolid food: they uſually continue in this ſtate for many months; during which, all liquid foods, and even ſolids themſelves, when cut ſmall and ſwallowed leiſurely, are got down without much difficulty: by degrees the evil increaſes, and the paſſage through the œſophagus becomes ſo narrow, that not the ſmalleſt ſolid whatever can paſs through it; but, after having been detained for ſome time at the part where the obſtacle is formed, is returned again with a hollow noiſe of a very peculiar kind, and with the appearance of convulſion.

The ſeat of this malady is ſometimes near the top of the œſophagus, and at other times farther down, nearer the ſuperior orifice of the ſtomach. In this laſt caſe, the part of the alimentary tube which is above the obſtruction is frequently ſo dilated by the food which is detained in it as to be capable of containing a large quantity; and the kind of vomiting, by which it is again returned through the mouth, comes on ſooner or later after the attempt to ſwallow, in proportion to the nearneſs or remoteneſs of the part affected. In the laſt ſtage of this diſeaſe, not even liquids themſelves can be ſwallowed ſo as to paſs into the ſtomach, and the patient dies literally ſtarved to death.

On the diſſection of ſuch as have died in this manner, the œſophagus is found to be conſiderably thickened; and in ſome ſo contracted within at the diſeaſed part, as ſcarcely to admit the paſſing of a common probe; in others, to adhere together in ſuch a manner as entirely to cloſe up the paſſage, and not to be ſeparated without great difficulty.

He comes next to ſhow what he has found to be the moſt efficacious method of treating this diſeaſe, which, though not uncommon, yet in general has been conſidered as incurable.

He claims not the merit of having diſcovered the method of cure, but hopes that ſome ſervice may ariſe from publiſhing what his experience has confirmed to him; having firſt received the hint from another eminent phyſician.

Cerhalalgia.

The only medicine, then, from the use of which he has ever found any service, is mercury; and in cases which are recent, and where the symptoms have not risen to any great height, small doses of mercury given every right, and prevented, by purgative medicines, from affecting the mouth, have accomplished the cure.

But where the complaint has been of long standing, and the symptom has come on of the food's being returned through the mouth, a more powerful method of treatment becomes necessary. In this case he has never found any thing of the least avail in removing any of the symptoms, but mercury, used in such a manner as to raise a gentle but constant spitting: and this method he has pursued with the happiest success. If this method be commenced before the complaint has gained too much ground upon the constitution, the case is not to be despaired of; and of those who have come under his care in this state, by much the greater part have received considerable benefit from it, and many have been entirely cured.

The complaint itself he observes, is not very uncommon; but there is no instance, to his knowledge, recorded, of success from any other manner of treating it, than that he has recommended.

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Worms.

Those infesting the human body are chiefly of three kinds: the *ascarides*, or small round and short white worms; the *teres*, or round and long worm; and the *tænia*, or tape worm.

The *ascarides* have usually their seat in the rectum.—The *teretes* or *lumbrici* are about a span long, round and smooth: they are seated for the most part in the upper small intestines; but sometimes they are lodged also in the stomach, and in any part of the intestines, even to the rectum.—The tape worms are from two to forty feet long, according to the testimony of Platerus; they generally possess the whole tract of the intestines, but especially the ileum: they very much resemble a tape in their appearance, whence the name of *tape-worm*: but another species of this genus, from the resemblance of each joint to a gourd seed, has the name of the *gourd-worm*.

In the Medical Transactions, Vol. I. Dr Heberden gives a very accurate account of the symptoms produced by the *ascarides*, from an eminent physician who was troubled with them all his life. They brought on an uneasiness in the rectum, and an almost intolerable itching in the anus; which sensations most usually came on in the evening, and prevented sleep for several hours. They were attended with heat, sometimes so considerable as to produce a swelling in the rectum both internally and externally; and if these symptoms were not soon relieved, a tenesmus was brought on, with a mucous dejection. Sometimes there was a griping pain in the lower part of the abdomen, a little above the *os pubis*. If this pain was very severe, a bloody mucus followed, in which there was often found ascarides alive. They were also sometimes suspected of occasioning disturbed sleep, and some degree of head-ach.

On this case Dr Heberden observes, that the general health of the patient did not seem to have suffered from the long continuance of the disease, nor the immediate inconveniences of the disorder itself to have increased. "It is (says he) perhaps universally true, that this kind of worms, though as difficult to be cured as any, yet is the least dangerous of all. They have been known to accompany a person through the whole of a long life, without any reason to suspect that they had hastened its end. As in this case there was no remarkable sickness, indigestion, giddiness, pain of the stomach, nor itching of the nose, possibly these symptoms, where they have happened to be joined with the ascarides, did not properly belong to them, but arose from some other causes. There is indeed no one sign of these worms, but what in some patients will be wanting."

The abovementioned patient used purging and irritating clysters with very little success. One drachm and an half of tobacco was infused in six ounces of boiling water; and the strained liquor being given as a clyster, occasioned a violent pain in the lower part of the abdomen, with faintness and a cold sweat: this injection, though retained only one minute, acted as a smart purge, but did little or no good. Lime-water was also used as a clyster; which brought on a costiveness, but had no good effect. Six grains of salt of steel were dissolved in six ounces of water, and injected. This clyster in a few minutes occasioned an aching in the rectum, griped a little without purging, and excited a tenesmus. Some few ascarides were brought off with it; but all of them were alive. The uneasy sensation in the rectum did not abate till some warm milk was thrown up. Whenever the tenesmus or mucus stools were thought worth the taking notice of, warm milk and oil generally gave immediate relief. If purging was necessary, the lenient purges, such as manna with oil, were, in this particular case, made use of: rhubarb was found too stimulating.—But, in general, the most useful purge, and which therefore was most usually taken, was cinnabar and rhubarb, of each half a drachm: this powder seldom failed to bring away a mucus as transparent as the white of an egg, and in this many ascarides were moving about. The cinnabar frequently adhered to this mucus, which did not come off in large quantities, when a purge was taken without cinnabar. Calomel did no more than any other purge which operates briskly would have done; that is, it brought away ascarides, with a great deal of mucus. Oil given as a clyster sometimes brought off these animalcules: the oil swam on the surface of the mucus, and the ascarides were alive and moving in the mucus itself, which probably hindered the oil from coming in contact with them and killing them.

The Doctor also observes, that mucus or slime is the proper nest of the ascarides, in which they live, and is perhaps the food by which they are nourished; and it is this mucus which preserves them unhurt, though surrounded with many other liquors, the immediate touch of which would be fatal. It is hard to satisfy ourselves by what instinct they find it out in the human body, and by what means they get at it; but it is observable in many other parts of nature, as well as here, that where there is a fit soil for the hatching and growth of animals and vegetables, nature has taken sufficient care that their seeds should find the way thither. Worms are said to have been found in the intestines of infants born dead. Purges, by

Worms. by lessening this slime, never fail to relieve the patient: and it is not unlikely, that the worms which are not forced away by this quickened motion of the intestines, may, for want of a proper quantity of it, languish, and at last die; for if the ascarides are taken out of their mucus, and exposed to the open air, they become motionless, and apparently die in a very short time. Dr Heberden supposes that the kind of purge made use of is of some consequence in the cure of all other worms as well as ascarides; the animals being always defended by the mucus from the immediate action of medicines: and that therefore those purges are the best which act briskly, and of which a repetition can be most easily borne. Purging waters are of this sort, and jalap especially for children; two or more grains of which, mixed with sugar, are most easily taken, and may be repeated daily.

From the case above-mentioned, and from Dr Heberden's observations, we may easily see why it is so difficult to destroy these animals; and why anthelmintics, greatly celebrated for some cures, are yet so far from being specifics in the disease. As the worms which reside in the cavities of the human body are never exposed to the air, by which all living creatures are invigorated, it is evident, that in themselves they must be the most tender and easily destructible creatures imaginable, and much less will be requisite to kill them than any of our common insects. The most pernicious substances to any of the common insects are oil, caustic fixed alkali, lime, and lime-water. The oil operates upon them by shutting up the pores of their bodies; the lime-water, lime, and caustic alkali, by dissolving their very substance. In the case of intestinal worms, however, the oil can have very little effect upon them, as they are defended from it by the moisture and mucus of the intestines; the like happens with lime-water: and therefore it is necessary that the medicine should be of such a nature as to destroy both mucus and insects together: for which purpose the caustic fixed alkali is at once safe and efficacious; nor is it probable that any case of worms whatever could resist the proper use of this medicine. A very large dose of any salt indeed will also destroy the mucus and destroy the worms; but it is apt to inflame and excoriate the stomach and intestines, and thus to produce worse distempers than that which it was intended to cure. Dr Heberden gives the following remarkable case of a patient cured of worms by enormous doses of common salt, after trying many other remedies in vain. In February 1757, the patient was seized with uncommon pains in his stomach, attended with nausea, vomiting, and constipation of bowels, and an almost total loss of sleep and appetite: He soon became much emaciated, and could neither stand nor walk upright; his belly grew small and hard, and closely retracted, insomuch that the sternum covered the navel, and the latter could scarce be discovered or felt by the finger: his urine was always milky, and soon deposited a thick white sediment; his excrements were very hard and lumpy, resembling those of sheep, only of a brown colour; nor had he ever a stool without some medicine or other to procure it. In this situation he continued four years; during which time he had been in an infirmary, attended by eminent physicians, but was dismissed as incurable. At last he was advised by a neighbour to drink salt and water, as he said he knew one cured by it who had for many years been afflicted with the same kind of pains in the belly and stomach. As his distemper was now almost insupportable, he willingly tried the experiment. Two pounds of common salt were dissolved in as little water as possible, all which he drank in less than an hour. Soon afterwards he found himself greatly oppressed at the stomach, grew extremely sick, and vomited violently; on the fourth straining he brought up about half a pint of small worms, part ascarides, and the rest resembling those worms which are called the *botts*, and frequently met with in the stomach of horses, but much smaller, and about the size of a grain of wheat. The salt soon began to operate downwards, and he had five or six very copious fetid stools, tinged with blood; and in them discharged near an equal quantity of the same kind of worms he had vomited. Being greatly fatigued with the violence of the operations, he fell into a calm sleep, which lasted two hours, during which he sweated profusely, and awoke much refreshed. Instead of his usual pains, he now only complained of a rawness and soreness of his gullet, stomach, and bowels, with an almost unquenchable thirst; to allay which, he drank large quantities of cold water, whey, butter-milk, or whatever he could get. The urine he now passed was small in quantity, and rendered with very great difficulty, being highly saturated with the salt, from whence arose a most troublesome dysuria and strangury. However, these symptoms gradually abated by a free use of the liquors abovementioned; and on the third morning he was so well recovered, that he took two pounds more of salt, dissolved in the like quantity of water. The effects were nearly similar to the former; only that most of the worms were now burst, and came away with a considerable quantity of slime and mucus. The drought, strangury, &c. returned with their former violence, but soon yielded to the old treatment. He sweated very copiously for three days, slept easily, and by that time could extend his body freely; on the fifth day he left his bed, and, though very weak, could walk upright; his strength and appetite soon returned, and he became robust and well.

The anthelmintic medicines which have been recommended by one person or other, are in a manner innumerable; but the principal are,

1. *Quicksilver.* This is very efficacious against all kinds of worms, either taken in the form of calomel or corrosive sublimate. Even the crude metal boiled in water and the water drunk, has been recommended as an almost certain cure. But this, it is evident, can receive no impregnation from the mercury. If, therefore, it have any effect, it must be from some foreign and accidental impregnation. In most instances there can be no objection to mercury, but only that it is not endowed with any attenuating quality whereby the mucus in which these insects reside can be dissolved. It therefore fails in many cases, though it will most certainly destroy worms where it can get at them.

2. *Powder of tin.* This was for some time celebrated as a specific; and indeed we may reasonably expect good effects from it; as by its weight and grittiness

Worms. grittineſs it rubs off the mucus and worms it contains from the coats of the inteſtinal canal, in which caſe they are eaſily evacuated by purgatives. In order to produce any conſiderable effects, it muſt be given in a large doſe.

3. *Geoffræa-inermis, or cabbage bark.* This remedy is uſed by the inhabitants of Jamaica. The firſt account of it which appeared in Britain was publiſhed in the Phyſical and Literary Eſſays, vol. ii. by Mr Duguid ſurgeon in that iſland. He acquaints us, that the inhabitants of Jamaica, young and old, white and black, are much infeſted with worms, eſpecially the long round ſort; the reaſon of which, he thinks, is the quantity of ſweet viſcid vegetables which they eat. On diſſecting a child of ſeven months old, who died of vomiting and convulſions, twelve large worms were found; one of them filled the *appendix vermiformis*, and three of them were intwiſted in ſuch a manner as to block up the *valvula Tulpii*, ſo that nothing could paſs from the ſmall to the great guts.—The cabbage-bark, however, he tells us, is a ſafe and effectual remedy, and the moſt powerful vermifuge yet known; and that it frequently brings away as many worms by ſtool as would fill a large hat. He owns that it has ſometimes violent effects; but this he aſcribes to the negroes who make the decoction (in which form the bark is uſed), and not to the remedy itſelf.

Mr Anderſon, ſurgeon in Edinburgh, has alſo given an account of this bark and its operation, in a letter to Dr Duncan, publiſhed in the Edinburgh Medical Commentaries, volume iv. p. 84. From this account it appears, that there are two different kinds of bark; the one much paler than the other: the pale kind operates much more violently than the other. It often occaſions looſe ſtools, great nauſea, and ſuch like ſymptoms, attended with great uneaſineſs in the belly: in one or two inſtances it was ſuſpected of inducing ſyncope. The darker coloured kind reſembles the caſſia lignea, though it is of a much coarſer texture. This kind, Mr Anderſon thinks, may be exhibited in any caſe where an anthelmintic is neceſſary; the dangerous ſymptoms might have followed either from the uſe of the firſt kind, or from an over-doſe of the ſecond. The uſual method of preparing the medicine is by boiling two ounces and a half of the bark in two quarts of water to a pint and a half. Of this a tea-ſpoonful may be given at firſt in the morning, gradually increaſing the quantity till we come to four or five table ſpoonfuls in a day. When exhibited in this manner, Mr Anderſon informs us, that he never ſaw it produce any violent ſymptoms, and has experienced the beſt effects from it as an anthelmintic. After the uſe of this decoction for eight or nine mornings ſucceſſively, a doſe of jalap with calomel muſt be given, which ſeldom fails to bring away the worms, ſome dead, ſome alive. If at any time the decoction produce more than one or two looſe ſtools, a few drops of liquid laudanum may be given; and, in general, Mr Anderſon gave 15 or 20 drops of the ſpirit of lavender with each doſe. Worms.

In a letter from Dr Ruſh, profeſſor of chemiſtry at Philadelphia, to Dr Duncan of Edinburgh, the following account is given of another preparation of this medicine. "It has long (ſays he) been a complaint among phyſicians, that we have no *vermifuge* medicine which can be depended upon. Even calomel fails in many caſes where there are the moſt pathognomonic ſigns of worms in the bowels. But this complaint, it is hoped, is now at an end. The phyſicians of Jamaica have lately found, that the *cabbage-bark*, as it is called in the Weſt Indies, made into a ſyrup with brown ſugar, is an infallible antidote to them. I have uſed above 30 pounds of it, and have never found it fail in one inſtance. The ſyrup is pleaſant; it ſometimes pukes, and always purges, the firſt or ſecond time it is given."

Notwithſtanding theſe encomiums, however, the cabbage-bark (A) hath not come into general uſe in Britain. But diſeaſes from the *teretes*, or *lumbrici* as they are often called, the ſpecies of worm againſt which this bark is employed, much leſs frequently occur than in ſome other countries. When they do occur, in almoſt every inſtance they readily yield to more gentle and ſafe anthelmintics; and the worms may not only be expelled by calomel, but by the vegetable bitters; as the powder of the ſemen ſantonicum, or the like.

4. *Couhage*, or *cow-itch*. This is the *Dolichos urens* or *pruriens* of Linnæus; and the principles on which it acts have been already explained under the article Dolichos. It is ſomewhat ſimilar to the powder of tin, but bids fair for being more efficacious. It might at firſt appear to occur as objections to this medicine, that by the hairs of it entangling themſelves with one another, calculi might be formed in the inteſtines, or obſtructions equally bad; or if the ſharp points and hooks with which it abounds were to adhere to the nervous coats of the inteſtines themſelves, they might occaſion a fatal irritation, which could not be removed by any means whatever. But from the experience of thoſe who have employed it extenſively in practice, it would appear, that theſe objections are entirely theoretical; and that it may be employed with perfect ſafety. The ſpiculæ, gently ſcraped off from a ſingle pod, and mixed with ſyrup or melaſſes, are taken for a doſe in the morning faſting. It is repeated in this manner for two or three days without any ſenſible operation; but even a very ſlight purgative taken afterwards has been found to diſcharge an almoſt incredible quantity of worms. And according to Dr Bancroft, who has given a very particular account of its uſe in his Natural Hiſtory of Guaiana, it is one of the ſafeſt and moſt certain anthelmintics yet diſcovered; but, as well as the bark of the *Geoffræa*, it has hitherto been very little uſed in Britain, probably from its not being neceſſary.

5. *Indian pink.* The plant, which in the *Spigelia marilandica*

(A) The moſt accurate account of this vegetable, and its effects, has been given by Dr Wright in the Philoſophical Tranſactions, of which the reader will find a ſhort view under the article *Geoffræa*, in the order of the alphabet.

Worms. *marilandica* and Linnæus, is alſo an American plant, and was firſt recommended in the Edinburgh Phyſical and Literary Eſſays by Dr Garden of Charleſtown in South Carolina. He is of opinion that a vomit ought always to precede the uſe of it; and informs us, that half a drachm of it purges as briſkly as the ſame quantity of rhubarb. At other times he has known it produce no effect on the belly though given in very large quantity: In ſuch caſes it becomes neceſſary to add a grain or two of ſweet mercury, or ſome grains of rhubarb; but then it is leſs efficacious than when it proves purgative without addition, The uſe of it, however, in ſmall doſes, is by no means ſafe; as it frequently produces giddineſs, dimneſs of ſight, convulſions, &c. The addition of a purgative, indeed, prevents theſe effects; but at the ſame time, as already obſerved, it diminiſhes the virtue of the medicine. The Doctor therefore recommends large doſes, as from them he never knew any other effect than the medicine's proving emetic or violently cathartic. The doſe is from 12 to 60 or 70 grains of the root in ſubſtance, or two, three, or four drachms of the infuſion, twice a-day.

This medicine has alſo had its day, and is now very far from being conſidered as a ſpecific. From what has been already obſerved, it muſt pretty clearly appear, that powder of tin, cow-itch, or fixed alkaline ſalts, bid faireſt for deſtroying worms in all the variety of caſes in which they can occur. Alkalies indeed have been but little tried. We have known one caſe in which all the complaints have been removed by a ſingle doſe: we have alſo an inſtance of their efficacy, in an extraordinary caſe of a worm bred in the liver, mentioned in the 2d volume of the Medical Obſervations. The patient had a violent pain in the ſide, and ſometimes in the ſhoulder, as the worm ſhifted its place; but, on the application of a lixivial pouttice, the pain went out of the ſide entirely, and kept in the ſhoulder for ſome weeks.

The long round worms ſeem to be the moſt dangerous which infeſt the human body, as they often pierce through the ſtomach and inteſtines, and thus bring on a miſerable death. The common ſymptoms of them are nauſea, vomiting, looſeneſs, fainting, ſlender intermitting pulſe, itching of the noſe, and epileptic fits. By the conſumption of the chyle they produce hunger, paleneſs, weakneſs, coſtiveneſs, tumor of the abdomen, eructations, and rumbling of the inteſtines; but it is from the perforation of the inteſtines that the diſeaſe proves ſo frequently fatal. A child may be known to have worms from his cold temperament, paleneſs of the countenance, livid eye-lids, hollow eyes, itching of the noſe, voracity, ſtartings, and grinding of the teeth in ſleep; and more eſpecially by a very fetid breath. Very frequently, however, they are voided by the mouth and anus, in which caſe there is no room for doubt. In the Medical Commentaries, vol. II. we have an account of the inteſtines being perforated by a worm, and yet the patient recovered. The patient was a woman troubled with an inflammation in the lower part of the abdomen. The pain was ſo violent, that for ſix days ſhe ſlept none at all; the tumor then broke, diſcharged upwards of a pound of thin watery ſanies, immediately after which the excrements followed. The next day ſhe was extremely low; her pulſe could ſcarcely be felt; the extremities were cold; and there was a conſiderable diſcharge from the wound, which had already begun to mortify. She got a decoction of the bark with wine, which alleviated the ſymptoms; but in removing the mortified parts a worm was found among them nine inches long, and as thick as an eagle's quill. By proper applications, the diſcharge of excrements ceaſed, and ſhe recovered perfect health. She was ſenſible of no accident giving riſe to the inflammation; ſo that in all probability it aroſe entirely from the worm itſelf.

The *tænia*, or *tape-worm*, as it is called, is one of thoſe moſt difficult to be removed from the human body. It is of two kinds, *tænia ſolium* and *tænia lata*; for a deſcription of which ſee the article TÆNIA.—The reaſon of its being ſo difficult to cure, is, that though portions of it are apt to break off and be diſcharged, it is endowed with a power of reproduction, ſo that the patient is little or nothing better. The ſymptoms occaſioned by it are not different from thoſe above deſcribed. A ſpecific againſt the *tænia lata* hath been lately ſo much celebrated in France, that the king thought proper to purchaſe it from the proprietor (Madam Nouffer), and the account of it has been tranſlated into Engliſh by Dr Simmons. The patients are required to obſerve no particular regimen till the day before they take the ſpecific. That day they are to take nothing after dinner till about 7 o'clock; after which, they are to take the following ſoup: "Take a pint and an half of water, two or three ounces of good freſh-butter, and two ounces of bread cut into thin ſlices: add to this ſalt enough to ſeaſon it, and then boil it to the conſiſtence of panada." About a quarter of an hour after this, they take a biſcuit and a glaſs of white-wine, either pure or mixed with water; or even water alone, if they have not been accuſtomed to wine. If the patient has not been to ſtool that day, (which, however, is not uſual with patients in this way), the following clyſter is to be injected. "Take a ſmall quantity of the leaves of mallows, and boil them in a ſufficient quantity of water, mixing with it a little ſalt, and when ſtrained off add two ounces of oil olive." Next morning, about eight or nine hours after the ſupper abovementioned, the ſpecific is to be taken. This is no other than two or three drachms of the root of male fern, *polypodium filix mas* of Linnæus, gathered in autumn, and reduced to fine powder. It is to be taken in any diſtilled water, or in common water. This medicine is apt to occaſion a nauſea: to avoid which, Madam Nouffer allows her patients to chew any thing that is agreeable, but forbids any thing to be ſwallowed; or they may ſmell to vinegar, to check the ſickneſs: but if, notwithſtanding this, the ſpecific be thrown up, a freſh doſe muſt be ſwallowed as ſoon as the ſickneſs is gone off, and then they muſt try to ſleep. About two hours after this the following bolus is to be taken. "Take of the panacea of mercury 14 times ſublimed, and ſelect reſin of ſcammony, each ten grains; of freſh and good gamboge, ſix or ſeven grains: reduce each of theſe ſubſtances ſeparately into powder, and then mix them with ſome conſerve into a bolus." This compoſition is to be ſwallowed at two different times, waſhing it down with

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with one or two dishes of weak green-tea, after which the patient must walk about his chamber. When the bolus begins to operate, he is to take a dish of the same tea occasionally, until the worm be expelled; then, and not before, Madame Nouffer gives him broth or soup, and he is directed to dine as is usual after taking physic. After dinner he may either lye down or walk out, taking care to conduct himself discreetly, to eat but little supper, and to avoid every thing that is not of easy digestion.

The cure then is complete; but it is not always effected with the same quickness in every subject. He who has not kept down the whole bolus, or who is not sufficiently purged by it, ought to take, four hours after it, from two to eight drachms of Epsom salt dissolved in boiling water. The dose of this salt may be varied according to the temperament and other circumstances of the patient.

If the worm should not come away in a bundle, but in the form of a thread (which particularly happens when the worm is involved in much tenacious mucus), the patient must continue to sit upon the close stool without attempting to draw it away, drinking at the same time warm weak tea: sometimes this alone is not sufficient, and the patient is obliged to take another dose of purging salt, but without varying his position till the worm be wholly expelled.

It is unusual for patients who have kept down both the specific and purging dose, not to discharge the worm before dinner-time. This, however, sometimes happens when the dead worm remains in large bundles in the intestines, so that the fæces becoming more limpid towards the end of the purging, pass by it without drawing it with them. The patient may in this case eat his dinner; and it has been observed, that the food, joined to the use of a clyster, has brought about the expulsion of the worm.

Sometimes the worm is brought away by the action of the specific alone, before the patient has taken the purging bolus: when this happens, Madame Nouffer gives only two-thirds of it, or substitutes the salt in its stead.

Patients must not be alarmed by any sensation of heat or uneasiness they may feel during the action of the remedy, either before or after a copious evacuation, or just as they are about to void the worm. These sensations are transitory, and go off of their own accord, or by the assistance of the vapour of vinegar drawn in at the nose.

They who have vomited both the specific and bolus, or who have kept down only a part of them, sometimes do not void the worm that day. Madame Nouffer therefore directs them to take again that night the soup, the wine and biscuit; and if circumstances require it, the clyster. If the worm do not come away during the night; she gives them early the next morning another dose of the specific, and, two hours afterwards, six drachms or an ounce of purging salt, repeating the whole process of the preceding day; excepting the bolus, which she suppresses.

She observes, that very hot weather diminishes in some degree the action of her remedy; she therefore prefers the month of September for administering it; but as she has not been always able to choose the season, and has been sometimes obliged to undertake the cure of patients in the hottest days of summer, she then gave her specific very early in the morning; and with this precaution she saw no difference in its effects.

On the day appointed for the trial of this medicine before the commissioners nominated by the king of France, it was exhibited to five different persons; but only one of them was certainly known to have the *tænia lata* by having discharged parts of it before. That person was cured; the second voided a portion of the *tænia solium*; the third some *ascarides*, with a part of the *tænia solium*; the fourth and fifth voided no worms; but the last considered much of the viscid slime he voided to be worms in a dissolved state.

This trial was thought sufficient to ascertain the efficacy of the medicine, and further trials were made by those to whom the secret was communicated. The first voided two tænia, after much vomiting and 18 or 20 stools; the second had no vomiting, but was as violently purged, and discharged two worms; the third had 20 copious stools during the night, and dischaged the worm in the morning; and the fifth was effected in much the same manner. Some others who were not relieved, were supposed not to have a tænia.

This specific, however, is not to be considered as a new discovery; the efficacy of fern in cases of tenia having been known long ago. Theophrastus prescribes its root, in doses of four drams, given in water sweetened with honey, as useful in expelling flat worms.—Dioscorides orders it in the same dose, and adds, that its effects are more certain when it is mixed with four oboli (40 grains) of scammony or black hellebore; he particularly requires that garlic should be taken before hand. Pliny, Galen, Oribasius, and Aëtius, ascribe this same virtue to fern; and are followed in this by Avicenna, and the other Arabian, physicians. Dorstenius, Valerias Cordus, Dodonæus, Mathiolus, Dalechampius, who commented on Dioscorides, or copied him in many things, all mention the fern-root as a specific against the tænia. Sennertus, and Burnet after him, recommended in similar cases an infusion of this plant, or a dram of its powder for young persons, and three drams for adults, Simon Paulus, quoted by Ray and Geoffroy, considers it as the most efficacious of all poisons against the flat worm, and as being the basis of all the secret remedies extolled by emperics in that disease. Andry (*génér. des Vers, p.* 246, 249) prefers distilled fern-water to the root in powder, or he employs it only in the form of an opiate, or mixed with other substances.

These are not the only authors who have mentioned the tænia; many others have described this worm, the symptoms it excites, and the treatment proper to expel it. Almost all of them mention the fern-root, but at the same time they point out other remedies as possessing equal efficacy. Amongst these we find the bark of the root of the mulberry tree, the juice of the *auricula murus*, the roots of *chamælion niger*, ginger, zedoary; decoctions of mugwort, southernwood, wormwood, penny-royal, origanum, hyssop, and in general of all bitter and aromatic plants, &c. Some of them direct the specific to be simply mixed and taken in wine or honey and water; others join to it the use of some purgative remedy, which they say adds to its efficacy. Oribasius, Sylvius, &c. distinguish the specific

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Madame Nouffer's long experience has taught her to distinguish all these circumstances with singular adroitness.

This method of cure is, as we have seen, copied in a great measure from the ancients: it may be possible to produce the same effects by varying the remedies; but the manner of applying them is by no means indifferent: we shall be always more certain of success, if the intestines be previously evacuated, and if the specific be given some time before the purgative bolus. It is to this method that Madame Nouffer's constant success is attributed.

Her remedy has likewise some power over the *tænia solium;* but as the rings of this worm separate from each other more easily than those of the *tænia lata*, it is almost impossible for it to be expelled entire. It will be necessary therefore to repeat the treatment several times, till the patient cease to void any portions of worms. It must likewise be repeated, if, after the expulsion of one *tænia solium*, another should be generated in the intestinal canal. This last case is so rare, that it has been supposed that no person can have more than one of these worms; and for this reason it has been named *solitary worm*, which, being once removed, could never be renewed or replaced by a second: but experience has proved, that this notion is an ill-founded prejudice, and we know that sometimes these worms succeed each other, and that sometimes many of them exist together. Two living tæniæ have frequently been expelled from the same patient. Dr De Haen (*Rat. Med.* tom. viii. p. 157.) relates an instance of a woman who voided 18 tæniæ at once. In these cases the symptoms are usually more alarming; and the appetite becomes excessive, because these worms derive all their nourishment from the chyle. If too austere and ill judged a regimen deprives them of this, they may be expected to attack even the membranes of the intestines themselves. This evil is to be avoided by eating frequently.

Such are the precautions indicated in this disease. The ordinary vermifuge remedies commonly procured only a palliative cure, perhaps because they were too often improperly administered. But the efficacy of the present remedy, in the opinion of the French physicians, seems to be sufficiently confirmed by experience. To the above account, however, it seems proper to subjoin the following observations by Dr Simmons.

"A Swiss physician, of the name of *Herrenschwand*, more than 20 years ago, acquired no little celebrity by distributing a composition of which he styled himself the *inventor*, and which was probably of the same nature as Madame Nouffer's. Several very eminent men, as Tronchin, Hovius, Bonnet, Crammer, and others, have written concerning the effects of this remedy. It seems that Dr Herrenschwand used to give a powder by way of preparation, the night before he administered his specific. Nothing could be said with certainty concerning the composition either of one or the other. The treatment was said sometimes to produce most violent effects, and to leave the patients in a valetudinary state. Dr De Haen was dissuaded by his friends from using it, because it disordered the patients too much. It will be readily conceived, now that we are acquainted with Madame Nouffer's method that these effects were occasioned wholly by the purgative bolus. It is not strange, that resin of scammony or jalap, combined with *mercurius dulcis* and gamboge, all of them in strong doses, should in many subjects occasion the greatest disorders. It seems likely, however, that much of the success of the remedy depends on the use of a drastic purge. Some of the ancients who were acquainted with the virtues of the fern-root, observed that its efficacy was increased by scammony. Resinous purges especially when combined with mercury, have often been given with success in cases of *tænia*. Dr De Haen saw a worm of this sort five ells long expelled by the resin of jalap alone. Dr Gaubius knew a woman who had taken a variety of anthelmintic remedies without any effect, though she had voided a portion of *tænia* an ell and an half long previous to the use of these medicines: but at length, after taking a purge of singular strength, she voided the worm entire. Many other instances of the same kind are to be met with in authors. Other remedies have occasionally been given with success. In Sweden, it has been a practice to drink several gallons

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gallons of cold water, and then to take ſome draſtic purge. Boerhaave ſays, that he himſelf ſaw a *tænia* meaſuring 300 ells expelled from a Ruſſian by means of the *vitriolum martis*. All theſe methods, however have been too often ineffectual."

From ſome late accounts, there is reaſon to believe that Dr Herrenſchwand's remedy for *tænia* does not ſo exactly agree with that of Madame Nouffer as Dr Simmons ſeems to imagine. According to the account given us by a gentleman who had his information from Dr Herrenſchwand himſelf, it conſiſts entirely of gamboge and fixed vegetable alkali.

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THESE have all been treated of already, except the bites and ſtings of ſerpents, ſcorpions, &c. According to Dr Mead, the ſymptoms which follow the bite of a viper are, an acute pain in the place wounded, with a ſwelling, at firſt red, but afterwards livid, which by degrees ſpreads farther to the neighbouring parts; with great faintneſs, and a quick, low, and ſometimes interrupted pulſe; great ſickneſs at ſtomach, with bilious convulſive vomitings, cold ſweats, and ſometimes pains about the navel. Frequently a ſanious liquor runs from the ſmall wound, and little puſtules are raiſed about it: the colour of the whole ſkin in leſs than an hour is changed yellow, as if the patient had the jaundice. Theſe ſymptoms are very frequently followed by death, eſpecially if the climate be hot, and the animal of a large ſize. This is not, however, the caſe with all kinds of ſerpents. Some, we are aſſured, kill by a fatal ſleep; others are ſaid to produce an univerſal hemorrhagy and diſſolution of the blood; and others an unquenchable thirſt. But of all the ſpecies of ſerpents hitherto known, there is none whoſe bite is more expeditiouſly fatal than that of the rattle-ſnake. Dr Mead tells us, that the bite of a large ſerpent of this kind killed a dog in a quarter of a minute; and to the human ſpecies they are almoſt equally fatal. Of this ſerpent it is ſaid, that the bite makes the perſon's ſkin become ſpotted all over like the ſkin of the ſerpent; and that it has ſuch a motion as if there were innumerable living ſerpents below it. But this is probably nothing more than a diſſolution of the blood, by which the ſkin becomes ſpotted as in petechial fevers, at the ſame time that the muſcles may be convulſed as in the diſtemper called *hieranoſos*, which was formerly thought to be the effect of evil ſpirits: but it is even not improbable that obſervers have been ſomewhat aided by fancy and ſuperſtition when they thought that they detected ſuch appearances.

It has juſtly appeared ſurpriſing to philoſophers, how ſuch an inconſiderable quantity of matter as the poiſon emitted by a viper at the time of biting ſhould produce ſuch violent effects. But all inquiries into this matter muſt neceſſarily be uncertain; neither can they contribute any thing towards the cure. It is certain that the poiſon produces a gangrenous diſpoſition of the part itſelf, and likewiſe ſeemingly of the reſt of the body; and that the original quantity of poiſon continues ſome time before it exerts all its power on the patient, as it is known that removing part of the poiſonous matter by ſuction will alleviate the ſymptoms. The indications of cure then are three, 1. To remove the poiſonous matter from the body: Or, 2. If this cannot be done, to change its deſtructive nature by ſome powerful and penetrating application to the wound: And, 3. To counteract the effects of that portion already received into the ſyſtem.

The poiſonous matter can only be removed from the body by ſucking the wound either by the mouth, or by means of a cupping-glaſs; but the former is probably the more efficacious, as the ſaliva will in ſome meaſure dilute and perhaps obtund the poiſon. Mead directs the perſon who ſucks the wound to hold warm oil in his mouth, to prevent inflammation of the lips and tongue: but as bites of this kind are moſt likely to happen in the fields, and at a diſtance from houſes, the want of oil ought by no means ought to retard the operation, as the delay of a few minutes might prove of the moſt fatal conſequence; and it appears from Dr Mead's experiments, that the taking the poiſon of a viper into the mouth undiluted, is attended with no worſe conſequences than that of raiſing a ſlight inflammation. A quick exciſion of the part might alſo be of very great ſervice.

The only way of anſwering the ſecond indication is, by deſtroying the poiſoned part by a red-hot iron, or the application of alkaline ſalts, which have the power of immediately altering the texture of all animal-ſubſtances to which they are applied, provided they are not covered by the ſkin; and as long as the poiſon is not totally abſorbed into the ſyſtem, theſe muſt certainly be of uſe.

To anſwer the third indication, Dr Mead recommends a vomit of ipecacuanha, encouraged in the working with oil and warm water. The good effects of this, he ſays, are owing to the ſhake which it gives to the nerves, whereby the irregular ſpaſms into which their whole ſyſtem might be drawn are prevented. After this the patient muſt go to bed, and a ſweat muſt be procured by cordial medicines; by which the remaining effects of the poiſon will be carried off.

It has been confidently aſſerted by many, that the American Indians are poſſeſſed of ſome ſpecific remedy by which they can eaſily cure the bite of a rattle-ſnake. But Mr Cateſby, who muſt have had many opportunities of knowing this, poſitively denies that they have any ſuch medicine. They make applications indeed, and ſometimes the patient recovers; but theſe recoveries he aſcribes to the ſtrength of nature overcoming the poiſon, more than to the remedies made uſe of. He ſays, they are very acute in their prognoſtics whether a perſon that is bit will die or not; and when they happen to receive a bite in certain parts of the body, when the teeth of the animal enter a large vein, for inſtance, they quietly reſign themſelves to their fate, without attempting any thing for their own relief. Indeed, ſo violent and quick is the operation of this poiſon, that unleſs the antidote be inſtantly applied, the perſon will die before he can get to a houſe. It would ſeem therefore eligible for thoſe who are in danger of ſuch bites, to carry along with them ſome ſtrong alkaline ley, or dry alkaline ſalt, or both, which could be inſtantly clapt on the wound, and by its diſſolving power would deſtroy both the poiſon and the infected parts. Strong cordials alſo, ſuch as ardent ſpirits, volatile alkali, &c. might poſſibly excite the languid powers of nature, and enable her to expel

Poisons.

expel the enemy, which would otherwise prove too powerful. This seems to be somewhat confirmed from the account we have in the Philosophical Transactions of a gentleman bit by a rattle-snake, who was more relieved by a poultice of vinegar and vine-ashes put to his wound than any thing else. The vine-ashes being of an alkaline nature, must have saturated the vinegar, so that no part of the cure could be attributed to it: on the other hand, the ashes themselves could not have been saturated by the small quantity of acid necessary to form them into a poultice; of consequence they must have operated by their alkaline quality.—Soap-ley, therefore, or very strong salt of tartar, may reasonably be thought to be the best external application, not only for the bites of vipers, but of every venomous creature; and in fact we find *dry salt* universally recommended both in the bites of serpents and of mad dogs. Dr Mead recommends the fat of vipers presently rubbed into the wound; but owns that it is not safe to trust to this remedy alone.

Some years ago the volatile alkali was strongly recommended by M. Sage of the French academy, as a powerful remedy against the bite of the viper: and, by a letter from a gentleman in Bengal to Dr Wright, it would appear that this article, under the form of the *eau de luce*, which is very little if any thing different from the *spiritus ammoniæ succinatus* of the London Pharmacopoeia, has been employed with very great success against this affection in the East Indies: but from the trials made with it by the Abbé Fontana, published in his Treatise on the poison of the Viper, it would appear that it by no means answered his expectation: and the efficacy of this, as well as of the snake pills mentioned under the article HYDROPHOBIA, still requires to be confirmed by further experience.

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MELÆNE.

THIS is a distemper not very common, but it has been observed by the ancient physicians, and is described by Hippocrates under the name of *morbus niger*. It shows itself by a vomiting and purging of black tar-like matter; which Hippocrates, Boerhaave, and Van Swieten, supposed to be occasioned by atra bilis. But Dr Home, in his Clinical Experiments, shows that it is owing to an effusion of blood from the meseraic vessels, which by its stagnation and corruption assumes that strange appearance. The disease, he says, frequently follows hæmorrhagy; and those of a scorbutic habit are most subject to it. It is an acute disease, and terminates soon; yet is not attended with any great degree of fever. In one of Dr Home's patients the crisis happened on the eighth day by diarrhœa; in another, on the 14th, by sweat and urine; and a third had no evident critical evacuation.

As to the cure, Dr Home observes, that bleeding is always necessary where the pulse can bear it; nor are we to be deterred from it by a little weakness of the pulse, more than in the interitis. Emetics are hurtful, but purgatives are useful. But the most powerful medicine for checking this hæmorrhagy is the vitriolic acid: and, that this might be given in greater quantity, he mixed it with mucilage of gum arabic; by which means he was enabled to give double the quantity he could otherwise have done. The cold bath was tried in one instance, but he could not determine whether it was of any service or not. The cure was completed by exercise and the bark.

Diseases of Children.

Of the DISEASES *of* CHILDREN.

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Dr Buchan observes, that from the annual registers of the dead it appears, that about one half of the children born in Great Britain die under twelve years of age; and this very great mortality he attributes in a great measure to wrong management. The particulars of this wrong management enumerated by him are,

1. Mothers not suckling their own children. This, he owns, it is sometimes impossible for them to do; but where it can be done, he affirms that it ought never to be omitted. This, he says, would prevent the unnatural custom of mothers leaving their own children to suckle those of others; on which he passes a most severe censure, and indeed scarce any censure can be severe enough upon such inhumanity. Dr Buchan informs us, "He is sure he speaks within bounds, when he says not one in an hundred of these children live who are thus abandoned by their mothers." For this reason he adds, that no mother should be allowed to suckle another's child till her own be fit to be weaned. A regulation of this kind would save many lives among the poorer sort, and would do no harm to the rich; as most women who make good nurses are able to suckle two children in succession upon the same milk.

2. Another source of the diseases of children is the unhealthiness of parents: and our author insists that no person who labours under an incurable malady ought to marry.

3. The manner of cloathing children tends to produce diseases. All that is necessary here, he says, is to wrap the child in a soft loose covering; and the softness of every part of the infant's body sufficiently shows the injury which must necessarily ensue by pursuing a contrary method.

4. A new-born infant, instead of being treated with syrups, oils, &c. ought to be allowed to suck the mother's milk almost as soon as it comes into the world. He condemns the practice of giving wines and spirituous liquors along with the food soon after birth; and says, that if the mother or nurse has a sufficient quantity of milk, the child will need little or no other food before the third or fourth month. But to this it may reasonably be objected, not only that the nursing would thus be very severe on the mother; but if the child be left thus long without food, it will not easily relish it for some time, and its stomach is apt to be easily hurt by a slight change of diet after it has been long accustomed to one thing. Neither can it be shown, that the strongest and most healthy infants are those which get no other food but the mother's milk during the first months of their life. In fact, children are evidently of a weak and lax habit of body, so that many of their diseases must arise from that cause; all directions which indiscriminately advise an antiphlogistic regimen for infants as soon as they come into the world, must of necessity be wrong. Many instances in fact might be brought to show, that by the preposterous method of starving infants, and at the same time treating them with vomits and purges, they are

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often hurried out of the world. Animal-food indeed is excessively agreeable to children, and they ought to be indulged with it in moderation; and this will prove a much better remedy for those acidities with which children are often troubled, than magnesia alba, crab's eyes, or other absorbents, which have the most pernicious effects on the stomachs of these tender creatures, and pall the appetite to a surprising degree. The natural appetites of children are indeed the best rule by which we can judge of what is proper or improper for them. They must no doubt be regulated as to the quantity; but we may be assured that what a child is very fond of will not hurt it if taken in moderation. When children are sick, they refuse every thing but the breast; and if their distemper be very severe, they will refuse it also; and in this case they ought not to be pressed to take food of any kind: but when the sickness goes off, their appetite also returns, and they will require the usual quantity of food.

According to Dr Armstrong, *inward fits*, as they are called, are in general the first complaint that appears in children; and as far as he has observed, most, if not all infants, during the first months, are more or less liable to them. The symptoms are these. The child appears as if it was asleep, only the eyelids are not quite closed; and if you observe them narrowly, you will see the eyes frequently twinkle, with the white of them turned up. There is a kind of tremulous motion in the muscles of the face and lips, which produces something like a simper or a smile, and sometimes almost the appearance of a laugh. As the disorder increases, the infant's breath seems now and then to stop for a little; the nose becomes pinched; there is a pale circle about the eyes and mouth, which sometimes changes to livid, and comes and goes by turns; the child starts, especially if you go to stir it though ever so gently, or if you make any noise near it. Thus disturbed, it sighs, or breaks wind, which gives relief for a little, but presently it relapses into the dozing. Sometimes it struggles hard before it can break wind, and seems as if falling into convulsions; but a violent burst of wind from the stomach, or vomiting, or a loud fit of crying, sets all to rights again. As the child increases in strength, these fits are the more apt to go off spontaneously and by degrees; but in case they do not, and if there is nothing done to remove them, they either, degenerate into an almost constant drowsiness, (which is succeeded by a fever and the thrush), or else they terminate in vomitings, sour, curdled, or green stools, the watery-gripes, and convulsions. The thrush indeed very often terminates in these last symptoms. Wherefore, as these complaints naturally run into one another, or succeed one another, they may be considered, in a manner, as only different stages of the same disease, and which derive their origin from the same cause. Thus, the inward fits may be looked upon as the first stage of the disorder; the fever, and thrush (when it happens), as the second; the vomitings, sour, curdled, green or watery stools, as the third; and convulsions, as the last.

As to the cause of these complaints, he observes, that in infants the glandular secretions, which are all more or less glutinous, are much more copious than in adults. During the time of sucking, the glands of the mouth and fauces being squeezed by the contraction of the muscles, spue out their contents plentifully; which afterwards mixing with the mucus of the gullet and stomach, render the milk of a slimy consistence, by which means it is not so readily absorbed into the lacteals; and as in most infants there is too great an acidity in the stomach, the milk is thereby curdled, which adds to the load; hence sickness and spasms, which, being communicated by sympathy to the nerves of the gullet and fauces, produce the convulsive motions above described, which go commonly by the name of *inward fits*. The air, likewise, which is drawn in during suction, mixing with the milk, &c. in the stomach, perhaps contributes towards increasing the spasms abovementioned. Dr Armstrong is the more induced to attribute these fits to the causes now assigned, that they always appear immediately after sucking or feeding; especially if the child has been long at the breast, or fed heartily, and has been laid down to sleep without having first broken wind, which ought never to be done. Another reason is, that nothing relieves them so soon as belching or vomiting; and the milk or food they throw up is generally either curdled, or mixed with a large quantity of heavy phlegm. In case they are not relieved by belching or vomiting, the fits sometimes continue a good while, and gradually abate, according as the contents of the stomach are pushed into the intestines; and as soon as the former is pretty well emptied, the child is waked by hunger, cries, and wants the breast; he sucks, and the same process is repeated.—Thus, some children for the first weeks are kept almost always in a dose, or seemingly so; especially if the nurses, either through laziness or want of skill, do not take care to rouse them when they perceive that it is not a right sleep, and keep them awake at proper intervals. This dozing is reckoned a bad sign amongst experienced nurses; who look upon it as a forerunner of the thrush, as indeed it often is; and therefore, when it happens, we ought to be upon our guard to use the necessary precautions for preventing that disorder.

For these disorders, the only remedy recommended by Dr Armstrong is antimonial wine, given in a few drops, according to the age of the infant. By this means the superabundant mucus will no doubt be evacuated; but at the same time we must remember, that this evacuation can only *palliate*, and not cure the disease. This can only be effected by tonics; and a decoction of the Peruvian bark, made into a syrup, will readily be taken by infants, and may be safely exhibited from the very day they come into the world, or as soon as their bowels are emptied of the meconium by the mother's milk or any other means.

Dr Clarke observes, that *fractures* of the *limbs*, and *compressions* of the *brain*, often happen in difficult labours; and that the latter are often followed by convulsions soon after delivery. In these cases, he says, it will be advisable to let the navel-string bleed two or three spoonfuls before it be tied. Thus the oppression of the brain will be relieved, and the disagreeable consequences just mentioned will be prevented. But if this has been neglected, and fits have actually come on, we must endeavour to make a revulsion by all the means in our power; as by opening the jugular vein, procuring an immediate discharge of the urine and meconium, and applying small blisters to the back, legs, or behind the ears. The semicupium, too, would seem to be useful in this case, by driving the oppressive load of fluids from the head and upper parts.

It

Diſeaſes of Children.

It ſometimes happens after a tedious labour, that the child is ſo faint and weak as to diſcover little or no ſigns of life. In ſuch a caſe, after the uſual cleanſing, the body ſhould be immediately wrapped in warm flannel, and briſkly toſſed about in the nurſe's arms, in order, if poſſible, to excite the languid circulation. If this fail, the breaſt and temples may be rubbed with brandy or other ſpirits; or the child may be provoked to cry, by whipping, or other ſtimulating methods, as the application of onion, or ſalt and ſpirit of hartſhorn, to the mouth and noſtrils. But after all theſe expedients have been tried in vain, and the recovery of the child abſolutely deſpaired of, it has ſometimes been happily revived by introducing a ſhort catheter or blow-pipe into the mouth, and gently blowing into the lungs at different intervals. Such children, however, are apt to remain weak for a conſiderable time, ſo that it is often no eaſy matter to rear them; and therefore particular care and tenderneſs will be required in their management, that nothing may be omitted which can contribute either to their preſervation or the improvement of their ſtrength and vigour.

All the diſorders which ariſe from a *retention* of the *meconium*, ſuch as the *red gum*, may eaſily be removed by the uſe of gentle laxatives; but the great ſource of mortality among children is the *breeding* of their *teeth*. The uſual ſymptoms produced by this are fretting; reſtleſſneſs; frequent and ſudden ſtartings, eſpecially in ſleep; coſtiveneſs; and ſometimes a violent diarrhœa, fever, or convulſions. In general, thoſe children breed their teeth with the greateſt eaſe, who have a moderate laxity of the bowels, or a plentiful flow of ſaliva during that time.

In mild caſes, we need only, when neceſſary, endeavour to promote the means by which nature is obſerved to carry on the buſineſs of dentition in the eaſieſt manner. For this purpoſe, if a coſtiveneſs be threatened, it muſt be prevented, and the body kept always gently open; and the gums ſhould be relaxed by rubbing them frequently with ſweet oils, or other ſoftening remedies of that kind, which will greatly diminiſh the tenſion and pain. At the ſame time, as children about this period are generally diſpoſed to chew what ever they get into their hands, they ought never to be without ſomething that will yield a little to the preſſure of their gums, as a cruſt of bread, a wax-candle, a bit of liquorice-root, or ſuch like; for the repeated muſcular action, occaſioned by the conſtant biting and gnawing at ſuch a ſubſtance, will increaſe the diſcharge from the ſalivary glands, while the gums will be ſo forcibly preſſed againſt the advancing teeth, as to make them break out much ſooner, and with leſs uneaſineſs, than would otherwiſe happen. Some likewiſe recommend a ſlice of the rind of freſh bacon, as a proper maſticatory for the child, in order to bring moiſture into its mouth, and facilitate the eruption of the teeth by exerciſing the gums. If theſe means, however, prove ineffectual, and bad ſymptoms begin to appear, the patient will often be relieved immediately by cutting the inflamed gum down to the tooth, where a ſmall white point ſhows the latter to be coming forward. When the pulſe is quick, the ſkin hot and dry, and the child of a ſufficent age and ſtrength, emptying the veſſels by bleeding, eſpecially at the jugular, will frequently be neceſſary here, as well as in all other inflammatory caſes; and the belly ſhould be opened from time to time by emollient oily or mucilaginous glyſters. But, on the contrary, if the child be low, ſunk, and much weakened, repeated doſes of the ſpirit of hartſhorn, and the like reviving medicines, ought to be preſcribed. Bliſters applied to the back, or behind the ears, will often be proper in both caſes. A prudent adminiſtration of opiates, when their uſe is not forbid by coſtiveneſs or otherwiſe, is ſometimes of great ſervice in difficult teething, as, by mitigating pain, they have a tendency to prevent its bad effects, as a fever, convulſions, or other violent ſymptoms; and often they are abſolutely neceſſary, along with the teſtaceous powders, for checking an immoderate diarrhœa.

When cathartics are neceſſary, but the child ſeems too tender and weak to bear their immediate operation, they ſhould be given to the nurſe; in which caſe they will communicate ſo much of their virtues to the milk as will be ſufficient to purge the infant. This at leaſt certainly holds with regard to ſome cathartics; ſuch, for example, as the infuſion of ſenna, particularly if a very weak infuſion be employed, and not uſed to ſuch an extent as to operate as a purgative to the nurſe.

As moſt young children if in health, naturally ſleep much, and pretty ſoundly, we may always be apt to ſuſpect that ſomething is amiſs when they begin to be ſubject to *watching* and *frights*; ſymptoms which ſeldom or never occur but either in conſequence of ſome preſent diſorder not yet taken notice of, or as the certain forerunners of an approaching indiſpoſition. We ſhould immediately, therefore, endeavour to find out their cauſe, that we may uſe every poſſible means to remove or prevent it; otherwiſe the want of natural reſt, which is ſo very prejudical to perſons of all ages, will ſoon reduce the infant to a low and emaciated ſtate, which may be followed by an hectic fever, diarrhœa, and all the other conſequences of weakneſs and debility. Theſe ſymptoms, being always the effects of irritation and pain, may proceed, in very young infants, from crudities or other affections of the *primæ viæ* producing flatulencies or gripes; about the ſixth or ſeventh month, they may be owing to that uneaſineſs which commonly accompanies the breeding of the teeth; and after a child is weaned, and begins to uſe a different kind of food, worms become frequently an additional cauſe of watchings and diſturbed ſleep. Hence, to give the neceſſary relief on theſe occaſions, the original complaint muſt firſt be aſcertained from the child's age and other concomitant circumſtances, and afterwards treated according to the nature of the caſe. Women and nurſes are too apt to have recourſe to opiates in the watchings of children, eſpecially when their own reſt happens to be much diſturbed by their continual noiſe and clamour. But this practice is often prejudicial, and never ought to have place when the belly is in the leaſt obſtructed.

There is no complaint more frequent among children than that of worms, the general ſymptoms of which have been already enumerated; but it muſt be obſerved, that all the ſymptoms commonly attributed to worms alone, may be produced by a foulneſs of the bowels. Hence practitioners ought never to reſt ſatisfied with adminiſtering to their patients ſuch medi-

cines,

cines as are possessed only of an anthelmintic quality, but to join them with those which are particularly adapted for cleansing the *primæ viæ;* as it is uncertain whether a foulness of the bowels may not be the cause of all the complaints. This practice is still the more advisable, on account of viscid humours in the intestines affording lodgment to the ova of worms; which, without the convenience of such a receptacle, would be more speedily discharged from the body.

The difficulty of curing what is called a *worm-fever*, arises, according to Dr Musgrave, from its being frequently attributed to worms, when the cause of the disorder is of a quite different nature. He does not mean to deny that worms do sometimes abound in the human body, nor that the irritation caused by them does sometimes produce a fever; but he apprehends these cases to be much more uncommon than is generally imagined, and that great mischief is done by treating some of the disorders of children as worm cases, which really are not so. Dr Hunter, it is observed, is of the same opinion on this point; and he has, we are told, dissected great numbers of children who have been supposed to die of worm-fevers, and whose complaints were of course treated as proceeding from worms, in whom however, there appeared, upon dissection, to be not only no worms, but evident proofs of the disorder's having been of a very different nature.

The *spurious worm-fever*, as Dr Musgrave terms it, has, in all the instances he has seen of it, arisen evidently from the children having been indulged with too great quantities of fruit; though a poor cold diet may, he thinks, occasionally give birth to it. Every sort of fruit eaten in excess will probably produce it; but an immoderate use of cherries seem to be the most common cause of it. The approach of this disorder has a different appearance, according as it rises from a habit of eating fruit in rather too large quantities, or from an excessive quantity eaten at one time. In the former case, the patient gradually grows weak and languid; his colour becomes pale and livid; his belly swells and grows hard; his appetite and digestion are destroyed; his nights grow restless, or at least his sleep is much disturbed with startings, and then the fever soon follows; in the progress of which, the patient grows comatose, and at times convulsed; in which state when it takes place to a high degree, he often dies. The pulse at the wrist, though quick, is never strong or hard; the carotids, however, beat with great violence, and elevate the skin so as to be distinctly seen at a distance. The heat is at times considerable, especially in the trunk; though at other times, when the brain is much oppressed, it is little more than natural. It is sometimes accompanied by a violent pain of the epigastric region, though more; commonly the pain is slight, and terminates in a coma; some degree of pain, however, seems to be inseparable from it, so as clearly to distinguish this disorder from other comatose affections.

When a large quantity of fruit has been eaten at once, the attack of the disorder is instantaneous, and its progress rapid; the patient often passing, in the space of a few hours, from apparently perfect health, to a stupid, comatose, and almost dying state. The symptoms of the fever, when formed, are in both cases nearly the same; except that, in this latter sort, a little purulent matter is sometimes discharged, both by vomit and stool, from the very first day. The stools, in both cases, exhibit sometimes a kind of curd resembling curdled milk, at other times a floating substance is observed in them; and sometimes a number of little threads and pellicles, and now and then a single worm.

Strong purgatives, or purges frequently repeated, in this disorder, are greatly condemned by Dr Armstrong, as they in general not only aggravate the symptoms already present, but are sometimes the origin of convulsions. Bloodletting is not to be thought of in any stage of the disorder.

Although frequent purging, however, be not recommended, yet a single vomit and purge are advised in the beginning of the disorder, with a view to evacuate such indigested matter and mucus as happens to remain in the stomach and bowels. These having operated properly, there is seldom occasion for repeating them; and it is sufficient, if the body be costive, to throw up, every second or third day, a clyster, composed of some grains of aloes, dissolved in five ounces of infusion of chamomile.

The principal part of the cure, however, depends upon external applications to the bowels and stomach; and as the cause of the disorder is of a cold nature, the applications must be warm, cordial, and invigorating; and their action must be promoted by constant actual heat.

The following is the form recommended.

"Take of leaves of wormwood and rue, each equal parts: make a saturated decoction in a sufficient quantity of water, with which foment the region of the stomach and abdomen for a quarter of an hour, repeating the fomentation every three or four hours. A poultice of the boiled herbs is to be applied after the fomentation, and constantly renewed as it cools." For internal use, the following is all that has been found necessary. "Take of spirituous and simple cinnamon-water, each half an ounce; oil of almonds, an ounce and an half: balsamic syrup, three drachms. Mix, and shake the vial when used." From two to six drachms are given every third hour.

When any nervous symptoms come on, or remain after the disorder is abated, they are easily removed by giving a pill with a grain or two of asafœtida once or twice a-day.

The diagnostics of worms are very uncertain; but, even in real worm cases, the treatment above recommended would, it is imagined, be much more efficacious than the practice commonly had recourse to. As worms either find the constitution weakly, or very soon make it so, the frequent repetition of purges, particularly mercurials, cannot but have a pernicious effect. Bares-foot is still more exceptionable, being in truth to be rather ranked among poisons than medicines. Worm-seed and bitters are too offensive to the palate and stomach to be long persisted in, though sometimes very useful. The powder of coralline creates disgust by its quantity; and the infusion of pink-root is well known to occasion now and then vertiginous complaints and fits.

Fomenting the belly night and morning with a strong decoction of rue and worm-wood, is much recommended. It is a perfectly safe remedy, and, by invigorating the bowels, may thereby have some influence in rendering them capable of expelling such worms

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worms as they happen to contain. After the fomentation, it is advised to anoint the belly with a liniment composed of one part of essential oil of rue, and two parts of a decoction of rue in sweet oil. It is, however, a matter of great doubt whether these external applications, in consequence of the articles with which they are impregnated, exert any influence on the worms themselves.

The diet of children disposed to worms, should be warm and nourishing, consisting in part at least of animal food, which is not the worse of being a little seasoned. Their drink may be any kind of beer that is well hopped, with now and then a small draught of porter or negus. A total abstinence from butter is not so necessary, perhaps, as is generally imagined. Poor cheese must by all means be avoided; but such as is rich and pungent, in a moderate quantity, is particularly serviceable. In the spurious worm-fever, the patient should be supported occasionally by small quantities of broth; and, at the close of it, when the appetite returns, the first food given should be of the kinds above recommended.

The diet here recommended will, perhaps, be thought extraordinary, as the general idea is at present, that, in the management of children, nothing is so much to be avoided as repletion and rich food. It is no doubt an error to feed children too well, or to indulge them with wine and rich sauces; but it is equally an error to confine them to too strict or too poor a diet, which weakens their digestion, and renders them much more subject to disorders of every kind, but particularly to disorders of the bowels. In regard to the spurious worm-fever, if it be true that acid fruits too plentifully eaten are the general cause of it, it follows as a consequence, that a warm nutritious diet, moderately used, will most effectually counteract the mischief, and soonest restore the natural powers of the stomach. Besides, if the disorder does not readily yield to the methods here directed, as there are many examples of its terminating by an inflammation and suppuration of the navel, it is highly advisable to keep this probability in view, and, by a moderate allowance of animal-food, to support those powers of nature, from which only such a happy crisis is to be expected.

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The application of this subtile fluid to medicinal purposes was thought of soon after the discovery of the electric shock; and after various turns of reputation its medical virtues seem now to be pretty well established. After giving so particular a description of the electrical apparatus under the proper article, it would here be superfluous to say any thing farther on that head. We shall only observe, that Mr Cavallo, who has published the latest and the best treatise on Medical Electricity entirely disapproves of giving violent shocks, and finds it most efficacious to expose the patient to the electrical aura discharged from an iron or a wooden point; or if shocks are given, they should be very slight, and not exceed 12 or 14 at a time. In this way he recommends it as effectual in a great number of disorders. The patient may be electrified from three to ten minutes; but if sparks are drawn, they should not exceed the number of shocks abovementioned.

Rheumatic disorders, even of long standing, are relieved, and generally quite cured, by only drawing the electric fluid with a wooden point from the part, or by drawing sparks through flannel. The operation should be continued for about four or five minutes, repeating it once or twice every day.

Deafness, except when it is occasioned by obliteration or other improper configuration of the parts, is either entirely or partly cured by drawing the sparks from the ear with the glass-tube director, or by drawing the fluid with a wooden point. Sometimes it is not improper to send exceedingly small shocks (for instance, of one-thirteenth of an inch) from one ear to the other.—It has been constantly observed, that whenever the ear is electrified, the discharge of the wax is considerably promoted.

The toothach, occasioned by cold, rheumatism, or inflammation, is generally relieved by drawing the electric fluid with a point, immediately from the part, and also externally from the face. But when the body of the tooth is affected, electrization is of no use; for it seldom or never relieves the disorder, and sometimes increases the pain to a prodigious degree.

Swellings in general, which do not contain any *matter*, are frequently cured by drawing the electric fluid with a wooden point. The operation should be continued for three or four minutes every day.—It is very remarkable, that in some cases of white swellings, quite cured by means of electricity, the bones and cartilages were in some measure disfigured.

Inflammations of every sort are generally relieved by a very gentle electrization.

In inflammmations of the eyes, the throwing of the electric fluid by means of a wooden point is often attended with great benefit; the pain being quickly abated, and the inflammation being generally dissipated in a few days. In these cases, the eye of the patient must be kept open; and care should be taken not to bring the wooden point very near it, for fear of causing any spark. Sometimes it is sufficient to throw the fluid with a metal point; for in these cases, too great an irritation should be always avoided. It is not necessary to continue this operation for three or four minutes without intermission, but after throwing the fluid for about half a minute, a short time may be allowed to the patient to rest and to wipe his tears, which generally flow very copiously; then the operation may be continued again for another half minute, and so on for four or five times every day.

The *gutta serena* has been sometimes cured by electrization; but at the same time it must be confessed, it has proved ineffectual in many such cases, in which it was administered for a long time and with all possible attention. However, it has never been known that any body was made worse by it. The best method of administering electricity in such cases, is first to draw the electric fluid with a wooden point for a short time, and then to send about half a dozen of shocks of one-twentieth of an inch from the back and lower part of the head to the fore head, very little above the eye.

A remarkable disease of the eye was some time ago perfectly cured by electrization; it was an opacity of the vitreous humour of the eyes.

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All these cases of *fistula lacrymalis* which Mr Cavallo hath known to have been electrified by persons of ability for a sufficient time, have been entirely cured. The method generally practised has been that of drawing the fluid with a wooden point, and to take very small sparks from the part, The operation may be continued for about three or four minutes every day. It remarkable, that in those cases, after curing the fistula lacrymalis, no other disease was occasioned by it, as blindness, inflammations, &c. by suppressing that discharge.

Palsies are seldom perfectly cured by means of electricity, especially when they are of long standing; but they are generally relieved to a certain degree. The method of electrifying in those cases, is to draw the fluid with the wooden point, and to draw sparks thro' flannel, or through the usual coverings of the part if they are not too thick. The operation may be continued for about five minutes per day.

Ulcers, or open sores of every kind, even of a long standing, are generally disposed to heal by electrization. The general effects are a diminution of the inflammation, and first a promotion of the discharge of properly formed matter; which discharge gradually lessens, according as the limits of the sore contract, till it be quite cured. In these cases the gentlest electrization must be used, in order to avoid too great an irritation, which is generally hurtful. To draw or throw the fluid with a wooden or even with a metal point, for three or four minutes per day, is fully sufficient.

Cutaneous eruptions have been successfully treated with electrization; but in these cases it must be observed, that if the wooden point be kept too near the skin, so as to cause any considerable irritation, the eruption will be caused to spread more; but if the point be kept at about six inches distance, or farther if the electrical machine be very powerful, the eruptions will be gradually diminished, till they are quite cured. In this kind of disease, the immediate and general effect of the wooden point is to occasion a warmth about the electrified part, which is always a sign that the electrization is rightly administered.

The application of electricity has perfectly cured various cases of *St Vitus's dance*, or of that disease which is commonly called so; for it is the opinion of some very learned physicians, that the real disease called *St Vitus's dance* which formerly was more frequent than it is at present, is different from that which now goes under that name. In this disease shocks of about one-tenth of an inch may be sent through the body in various directions, and also sparks may be taken. But if this treatment prove very disagreeable to the patient then the shocks must be lessened, and even omitted; instead of which some other more gentle applications must be substituted.

Scrophulous tumors, when they are just beginning, are generally cured by drawing the electric fluid with a wooden or metal point from the part. This is one of those kinds of diseases in which the action of electricity requires particularly the aid of other medicines in order to effect a cure more easily; for scrophulous affections commonly accompany a great laxity of the habit, and a general cachexy, which must be obviated by proper remedies.

In *cancers*, the pains only are commonly alleviated by drawing the electric fluid with a wooden or metal point. Mr Cavallo, however, mentions one case in which a most confirmed cancer of very long standing, on the breast of a woman, had been much reduced in size. It is remarkable, that this patient was so far relieved by drawing the fluid with a metal point from the part, that the excruciating pains she had suffered for many years did almost entirely disappear; and also, that when the electric fluid was drawn by means of a wooden point, the pains did rather increase.

Abscesses, when they are in their beginning, and in general whenever there is any tendency to form matter, are dispersed by electrization. Lately, in a case in which matter was formed upon the hip, called the *lumbar abscess*, the disease was perfectly cured by means of electricity. The *sciatica* has also been often cured by it. In all such cases, the electric fluid must be sent through the part by means of two directors applied to opposite parts, and in immediate contact either with the skin, or with the coverings, when these are very thin. It is very remarkable, that the mere passage of the electric fluid in this manner is generally felt by the patients afflicted with those disorders, nearly as much as a small shock is felt by a person in good health. Sometimes a few shocks have been also given, but it seems more proper to omit them: because sometimes, instead of dispersing, they rather accelerate the formation of matter.

In cases of *pulmonary inflammations*, when they are in the beginning, electrization has been sometimes beneficial; but in confirmed diseases of the lungs, it does not seem to have ever afforded any unquestionable benefit; however, it seems that in such cases the power of electricity has been but seldom tried.

Nervous headachs, even of a long standing, are generally cured by electrization. For this disease, the electric fluid must be thrown with a wooden, and sometimes even with a metal point, all round the head successively. Sometimes exceedingly small shocks have been administered; but these can seldom be used, because the nerves of persons subject to this disease are so very irritable, that the shocks, the sparks, and sometimes even the throwing the electric fluid with a wooden point kept very near the head, throw them into convulsions.

The application of electricity has often been found beneficial in the *dropsy* when just beginning, or rather in the tendency to a dropsy; but it has never been of any use in advanced dropsies. In such cases, the electric fluid is sent through the part, in various directions, by means of two directors, and sparks are also drawn across the flannel or the cloaths; keeping the metal rod in contact with them, and shifting it continually from place to place. This operation should be continued at least ten minutes, and should be repeated once or twice a-day.—Perhaps in those cases, a simple electrization (viz, to insulate the patient, and to connect him with the prime conductur whilst the machine is in action), continued for a considerable time, as an hour or two, would be more beneficial.

The *gout*, extraordinary as it may appear, has certainly been cured by means of electricity, in various instances. The pain has been generally mitigated, and sometimes the disease has been removed so well as not to

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to return again. In those cases, the electric fluid has been thrown by means of a wooden point, although sometimes, when the pain was too great, a metal point only has been used.

Agues have not unfrequently been cured by electricity, so that sometimes one electrization or two have been sufficient. The most effectual and sure method has been that of drawing sparks through flannel, or the cloaths, for about ten minutes or a quarter of an hour. The patients may be electrified either at the time of the fit, or a short while before the time in which it is expected.

The suppression of the menses, which is a disease of the female sex that often occasions the most disagreeable and alarming symptoms, is often successfully and speedily cured by means of electricity, even when the disease is of long standing, and after the most powerful medicines used for it have proved ineffectual. The cases of this sort in which electrization has proved useless are so few, and the successful ones so numerous, that the application of electricity for this disease may be justly considered as an efficacious and certain remedy. Great attention and knowledge is required, in order to distinguish the arrest of the menses from a state of pregnancy. In the former, the application of electricity, as we observed above, is very beneficial; whereas, in the latter, it may be attended with very disagreeable effects: it is therefore a matter of great importance to ascertain the real cause of the disease, before the electricity be applied in those cases. Pregnant women may be electrified for other diseases, but always using very gentle means, and directing the electric fluid through other parts of the body distant from those subservient to generation. In the real suppression of the menses, small shocks, *i. e.* of about one-twentieth of an inch, may be sent through the pelvis; sparks may be taken through the cloaths from the parts adjacent to the seat of the disease; and also the electric fluid may be transmitted by applying the metallic or wooden extremities of two directors to the hips, in contact with the clothes; part of which may be removed in case they be too thick. Those various applications of electricity should be regulated according to the constitution of the patient. The number of shocks may be about 12 or 14. The other applications may be continued for two or three minutes; repeating the operation every day. But either strong shocks, or a stronger application of electricity than the patient can conveniently bear, should be carefully avoided; for by those means, sometimes more than a sufficient discharge is occasioned, which is not easily cured. In cases of uterine hæmorrhagies, it is not known that the application of electricity was ever beneficial. Perhaps a very gentle electrization, so as to keep the patient insulated and connected with the prime conductor whilst the electrical machine is in action, may be of some benefit.

In respect to *unnatural discharges* and *fluxes* in general, it may be observed, that some discharges are quite unnatural or adventitious, as the fistula lacrymalis, and some species of the venereal disease; but others are only increased natural discharges, such as the menses, perspiration, &c. Now the power of electricity in general has been found more beneficial for the first than for the second sort of discharges, which are mostly increased by it.

In the *venereal disease*, electrization has been generally forbidden; having commonly increased the pains, and other symptoms, rather than diminished them. Indeed, considering that any sort of stimulus has been found hurtful to persons afflicted with that disorder, it is no wonder that electricity has produced some bad effects, especially in the manner it was administered some time ago, viz. by giving strong shocks. However, it has been lately observed, that a very gentle application of electricity, as drawing the fluid by means of a wooden or metal point, is peculiarly beneficial in various cases of this kind, even when the disease has been of long standing. Having remarked above, that tumors, when just beginning, are dispersed, and that unnatural discharges are gradually suppressed by a judicious electrization, it is superfluous to describe particularly those states of the venereal disease in which electricity may be applied; it is only necessary to remind the operator to avoid any considerable stimulus in cases of this sort.

The application of electricity has been found also beneficial in other diseases besides those mentioned above; but as the facts are not sufficiently numerous, so as to afford the deduction of any general rules, we have not thought proper to take any particular notice of them.

We may lastly observe, that, in many cases, the help of other remedies to be prescribed by the medical practitioner will be required to assist the action of electricity, which by itself would perhaps be useless; and, on the other hand, electrization may often be applied to assist the action of other remedies, as of sudorifics, strengthening medicines, &c.

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THE antiseptic qualities of fixed air, or as it is now more generally called of the *aerial* or *carbonic acid*, have of late introduced it as a medicine in cases of putrid disorders, and various other complaints.—

Dr Percival observes, that though fatal if inspired in a very large quantity, it may in smaller quantities be breathed without danger or uneasiness. And it is a confirmation of this conclusion, that at Bath, where the waters copiously exhale this mineral spirit, the bathers inspire it with impunity. At Buxton also, where the bath is in a close vault, the effects of such effluvia, if noxious, must certainly be perceived.

Encouraged by these and some other considerations, he has administered fixed air in more than 30 cases of the *phthisis pulmonalis*, by directing his patients to inspire the steams of an effervescing mixture of chalk and vinegar through the spout of a coffee-pot. The hectic fever has in several instances been considerably abated, and the matter expectorated has become less offensive and better digested. He has not, however, been so fortunate in any one case as to effect a cure; although the use of mephitic air has been accompanied with proper internal medicines. But Dr Withering has been more successful. One phthisical patient under his care, by a similar course, entirely recovered; another was rendered much better; and a third, whose case was truly deplorable, seemed to be kept alive by it

Fixed Air. it more than two months. It may be proper to observe, that fixed air can only be employed with any prospect of success in the latter stages of the *phthisis pulmonalis*, when a purulent expectoration takes place. After the rupture and discharge of a vomica also, such a remedy promises to be a powerful palliative. Antiseptic fumigations and vapours have been long employed, and much extolled, in cases of this kind. The following experiment was made to determine whether their efficacy in any degree depends on the separation of fixed air from their substance.

One end of a bent tube was fixed in a phial full of lime-water; the other end in a bottle of the tincture of myrrh. The junctures were carefully luted; and the phial containing the tincture of myrrh was placed in water, heated almost to the boiling point, by the lamp of a tea-kettle. A number of air-bubbles were separated, but probably not of the mephitic kind; for no precipitation ensued in the lime-water. This experiment was repeated with the *tinct. Tolutana Ph. Ed.* and with *sp. vinos. camph.* and the result was entirely the same. The medicinal action therefore of the vapours raised from such tinctures, cannot be ascribed to the extrication of fixed air; of which it is probable bodies are deprived by chemical solution as well as by mixture.

If mephitic air be thus capable of correcting purulent matter in the lungs, we may reasonably infer it will be equally useful when applied externally to *foul ulcers*; and experience confirms the conclusion. Even the sanies of a cancer, when the carrot-poultice failed, has been sweetened by it, the pain mitigated, and a better digestion produced. But though the progress of the cancer seems to be checked by the fixed air, it is to be feared that a cure will not be effected. A palliative remedy, however, in a disease so desperate and loathsome, may be considered as a very valuable acquisition. Perhaps nitrous air might be still more efficacious. This species of factitious air is obtained from all the metals, except zinc, by means of the nitrous acid; as a sweetener and antiseptic, it far surpasses fixed air.

In the ulcerous *sore throat*, much advantage has been experienced from the vapours of effervescing mixtures drawn into the *fauces*. But this remedy should not supersede the use of other antiseptic applications.

In *malignant fevers*, wines abounding with fixed air may be administered to check the septic ferment, and sweeten the putrid *colluvies* in the *primæ viæ*. If the laxative quality of such liquors be thought an objection to the use of them, wines of a greater age may be given, impregnated with aerial acid.—The patient's common drink might also be medicated in the same way. A putrid diarrhœa frequently occurs in the latter stage of such disorders; and it is a most alarming and dangerous symptom. If the discharge be stopped by astringents, a putrid *fomes* is retained in the body, which aggravates the delirium, and increases the fever. On the contrary, if it be suffered to take its course, the strength of the patient must soon be exhausted, and death unavoidably ensue. The injection of mephitic air into the intestines, under these circumstances, bids fair to be highly serviceable. And in some cases of this kind the gas emitted from a mixture of chalk and oil of vitriol conveyed into the body by the machine employed for tobacco-clysters, quickly restrained the diarhœa, corrected the heat and fetor of the stools, and in a short time removed every symptom of danger. Fixed Air.

As a *solvent* of the *calculus*, its virtues have been already mentioned; but the experiments made on that subject do not determine the matter with sufficient accuracy.

Observations on the MEANS *of preserving* HEALTH.

I. RULES *for the management of* VALETUDINARIANS. 413

THAT part of the medical system which lays down rules for the preservation of health, and prevention of diseases, termed *Hygeine*, is not to be strictly understood as if it respected only those people who enjoy perfect health, and who are under no apprehensions of disease, for such seldom either desire or attend to medical advice; but should rather be considered as relating to valetudinarians or to such as, though not actually sick, may yet have sufficient reason to fear that they will soon become so: hence it is that the rules must be applied to correct morbific dispositions, and to obviate the various things that were shown to be the remote or possible causes of diseases.

From the way in which the several temperaments are usually mentioned by systematic writers, it should seem as if they meant that every particular constitution must be referred to one or other of the four; but this is far from being reducible to practice, since by much the greater number of people have constitutions so indistinctly marked, that it is hard to say to which of the temperaments they belong.

When we actually meet with particular persons who have evidently either,

1. Too much strength and rigidity of fibre, and too much sensibility;

2. Too little strength, and yet too much sensibility;

3. Too much strength, and but little sensibility; or,

4. But little sensibility joined to weakness;

we should look on such persons as more or less in the valetudinary state, who require that these morbific dispositions be particularly watched, lest they fall into those diseases which are allied to the different temperaments.

People of the first-mentioned temperament being liable to suffer from continued fevers, especially of the inflammatory species, their scheme of preserving health should consist in temperate living, with respect both to diet and exercise; they should studiously avoid immoderate drinking, and be remarkably cautious lest any of the natural discharges be checked. People of this habit bear evacuations well, especially bleeding: they ought not, however, to lose blood but when they really require to have the quantity lessened; because too much of this evacuation would be apt to reduce the constitution to the second-mentioned temperament, wherein strength is deficient, but sensibility redundant.

Persons of the second temperament are remarkably prone to suffer from painful and spasmodic diseases, and are easily ruffled; and those of the softer sex who have this

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this delicacy of habit, are very much disposed to hysterical complaints. The scheme here should be, to strengthen the solids by moderate exercise, cold bathing, the Peruvian bark, and chalybeate waters; particular attention should constantly be had to the state of the digestive organs, to prevent them from being overloaded with any species of saburra which might engender flatus, or irritate the sensible membranes of the stomach and intestines, from whence the disorder would soon be communicated to the whole nervous system. Persons of this constitution should never take any of the drastic purges, nor strong emetics; neither should they lose blood but in cases of urgent necessity. But a principal share of management, in these extremely irritable constitutions, consists in avoiding all sudden changes of every sort, especially those with respect to diet and clothing, and in keeping the mind as much as possible in a state of tranquillity: hence the great advantages which people of this frame derive from the use of medicinal waters drunk on the spot, because of that freedem from care and serious business of every kind, which generally obtains in all the places laid out for the reception of valetudinarians.

The third-mentioned temperament, where there is an excess of strength aud but little sensibility, does not seem remarkably prone to any distressing or dangerous species of disease; and therefore it can hardly be supposed that persons so circumstanced will either of themselves think of any particular scheme of management, or have recourse to the faculty for their instructions: such constitutions, however, we may observe, bear all kinds of evacuations well, and sometimes require them to prevent an over-fulness, which might end in an oppression of the brain or some other organ of importance.

But the fourth temperament where we have weakness joined to want of sensibility, is exceedingly apt to fall into tedious and dangerous diseases, arising from a defect of absorbent power in the proper sets of vessels, and from remissness of the circulation in general: whence corpulency, dropsy, jaundice, and different degrees of scorbutic affection. In order to prevent these, or any other species of accumulation and depravation of the animal fluids, the people of this constitution should use a generous course of diet, with brisk exercise, and be careful that none of the secretions be interrupted, nor any of the natural discharges suppressed. These constitutions bear purging well, and often require it; as also the use of emetics, which are frequently found necessary to supply the place of exercise, by agitating the abdominal viscera, and are of service to prevent the stagnation of bile, or the accumulation of mucous humours, which hinder digestion, and clog the first passages. The free use of mustard, horse-radish, and the like sort of stimulating dietetics, is serviceable in these torpid habits.

When the general mass of fluids is accumulated beyond what is conducive to the perfection of health, there arises what the writers term a *plethora*, which may prove the source of different diseases; and therefore, when this overfulness begins to produce languor and oppression, care should be taken in time to reduce the body to a proper standard, by abridging the food and increasing the natural discharges, using more exercise, and indulging less in sleep.

But in opposite circumstances, where the fluids have been exhausted, we are to attempt the prevention of further waste by the use of strengthening stomachics, nourishing diet, and indulgence from fatigue of body or mind.

Vitiated fluids are to be considered as affected either with the different kinds of general acrimony, or as betraying signs of some of the species of morbific matter which give rise to particular diseases, such as gout, rheumatism, calculus, scurvy, &c.

During the state of infancy, we may sometimes observe a remarkable acidity, which not only shows itself in the first passages, but also seems to contaminate the general mass of fluids. As it takes its rise, however, from weak bowels, our views, when we mean to prevent the ill consequences, must be chiefly directed to strengthen the digestive organs, as on their soundness the preparation of good chyle depends; and hence small doses of rhubarb and chalybeates (either the natural chalybeate waters mixed with milk, or the *flores martiales* in doses of a few grains, according to the age of the child), are to be administered; and the diet is to be so regulated as not to add to this acid tendency: brisk exercise is likewise to be enjoined, with frictions on the stomach, belly, and lower extremities.

Where the fluids tend to the putrescent state, which shows itself by fetid breath, sponginess, and bleeding of the gums, a bloated look and livid cast, the diet then should be chiefly of fresh vegetables and ripe fruits, with wine in moderation, brisk exercise, and strengthening bitters.

Where acrimony shows itself by itching eruptions, uncommon thirst, and flushing heats, nothing will answer better than such sulphureous waters as the Harrowgate and Moffat in Britain, or the Lucan and Swadlinbar in Ireland; at the same time using a course of diet that shall be neither acrid nor heating.

So far with respect to those kinds of morbific matter which do not invariably produce a particular species of disease: but there are others of a specific nature, some of which are generated in the body spontaneously, and seem to arise from errors in diet, or other circumstances of ill management with respect to the animal economy; and hence it is sometimes possible, in some degree if not altogether, to prevent the ill consequences. Thus, there are instances where returns of the gout have been prevented by adhering strictly to a milk diet.

The rheumatism has also been sometimes warded off by wearing a flannel shirt, or by using the cold bath without interruption.

Calculus may be retarded in its progress, and prevented from creating much distress, by the internal use of soap and lime-water, by soap-lees taken in milk or in veal-broth, or by the use of aerated alkaline water, which may perhaps be considered as being both more safe and more efficacious, and at the same time more pleasant, than any of the other practices.

The scurvy may be prevented by warm clothing and perseverance in brisk exercise, by drinking wine or cyder, and eating freely of such vegetable substances as can be had in those situations where this disease is most apt to show itself.

In constitutions where there is an hereditary disposition

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ſition to the ſcrofula, if early precautions be taken to ſtrengthen the ſolids by cold bathing, a nouriſhing courſe of diet, and moderate uſe of wine, the acrimony which gives riſe to the diſeaſe will probably be prevented from producing very bad effects.

The other kinds of morbific matter, which are of the ſpecific nature are received into the body by infection or contagion.

The infection of a putrid fever or dyſentery is beſt prevented by immediately taking an emetic on the firſt attack of the ſickneſs or ſhivering; and if that do not completely anſwer, let a large bliſter be applied between the ſhoulders: by this method the nurſes and other attendants on the ſick in the naval hoſpitals have often been preſerved. As to other infectious morbific matter, we muſt refer to what has already been ſaid when treating of hydrophobia, poiſons, &c.

The ill effects which may ariſe from the different ſpecies of ſaburra, are to be obviated, in general by the prudent adminiſtration of emetics, and carefully abſtaining from ſuch kinds of food as are known to cauſe the accumulation of noxious matters in the firſt paſſages.

Crude vegetables, milk, butter, and other oily ſubſtances, are to be avoided by perſons troubled with a ſourneſs in the ſtomach; briſk exerciſe, eſpecially riding, is to be uſed, and they are to refrain from fermented liquors: the common drink ſhould be pure water; or water with a very little of ſome ardent ſpirit, ſuch as rum or brandy. Seltzer and Vahls water are to be drunk medicinally; and aromatic bitters, infuſions, or tinctures, with the acid elixir of vitriol, from 10 to 20 drops, will be found ſerviceable, in order to ſtrengthen the fibres of the ſtomach, and promote the expulſion of its contents, thereby preventing the too haſty fermentation of the alimentary mixture. In order to procure immediate relief, magneſia alba, or *creta præparata*, will ſeldom fail; the magneſia, as well as the chalk, may be made into lozenges, with a little ſugar and mucilage; and in that form may be carried about and taken occaſionally by people afflicted with the acid ſaburra.

In conſtitutions where there is an exuberance or ſtagnation of bile, and a troubleſome bitterneſs in the mouth, it is neceſſary to keep the bowels always free, by taking occaſionally ſmall doſes of pure aloes, *oleum ricini*, cream of tartar, ſome of the common purging ſalts, or the natural purging waters.

When there is a tendency to the empyreumatic and rancid ſaburra, people ſhould careſully avoid all the various kinds of thoſe oily and high-ſeaſoned things generally termed *made-diſhes* and eat ſparingly of plain meat, without rich ſauces or much gravy; and in theſe caſes the moſt proper drink is pure water.

II. Rules *for thoſe who enjoy perfect* Health.

414 There can be no doubt, that, in general, temperance is the true foundation of health; and yet the ancient phyſicians, as we may ſee in the rules laid down by Celſus did not ſcruple to recommend indulgence now and then, and allowed people to exceed both in eating and drinking: but it is ſafer to proceed to exceſs in drink than in meat: and if the debauch ſhould create any extraordinary or diſtreſſing degree of pain or ſickneſs, and a temporary fever ſhould enſue, there are two ways of ſhaking it off, either to lie in bed and encourage perſpiration, or to get on horſe-back and by briſk exerciſe reſtore the body to its natural ſtate. The choice of theſe two methods muſt always be determined by the peculiar circumſtances of the parties concerned, and from the experience which they may before have had which agrees beſt with them.

If a perſon ſhould commit exceſs in eating, eſpecially on high-ſeaſoned things, with rich ſauces, a draught of cold water, acidulated with vitriolic acid, will take off the ſenſe of weight at the ſtomach, and aſſiſt digeſtion, by moderating and keeping within bounds the alimentary fermentation, and thus preventing the generation of too much flatus. The luxury of ices may be here of real ſervice at the tables of the great, as producing ſimilar effects with the cold water acidulated. Perſons in theſe circumſtances ought not to lay themſelves down to ſleep, but ſhould keep up and exerciſe until they are ſenſible that the ſtomach is unloaded, and that they no longer feel any oppreſſive weight about the præcordia.

If a man be obliged to faſt, he ought, if poſible, during that time, to avoid laborious work: after ſuffering ſevere hunger, people ought not at once to gorge and fill themſelves; nor is it proper, after being overfilled, to enjoin an abſolute faſt: neither is it ſafe to reſt totally immediately after exceſſive labour, nor ſuddenly fall hard to work after having been long without motion: in a word, all changes ſhould be made by gentle degrees; for though the conſtitution of the human body be ſuch that it can bear many alterations and irregularities without much danger, yet, when the tranſitions are extremely ſudden, they cannot fail of producing ſome kind or degree of diſorder.

It is alſo the advice of Celſus to vary the ſcenes of life, and not confine ourſelves to any ſettled rules: but as inaction renders the body weak and liſtleſs, and exerciſe gives vigour and ſtrength, people ſhould never long omit riding, walking, or going abroad in a carriage; fencing, playing at tennis, dancing, or other ſimilar engagements, which afford both exerciſe and amuſement, as each ſhall be found moſt agreeable or convenient, are to be uſed in their turns, according to the circumſtances and tendency to any particular ſpecies of diſeaſe. But when the weakneſs of old age ſhall have rendered the body incapable of all theſe, then dry frictions with the fleſh-bruſh will be extremely requiſite to preſerve health, by accelerating the flow of humours through the ſmalleſt orders of veſſels, and preventing the fluids from ſtagnating too long in the cellular interſtices of the fleſhy parts.

Sleep is the great reſtorer of ſtrength; for, during this time, the nutritious particles appear to be chiefly applied to repair the waſte, and replace thoſe that have been abraded, and waſhed off by the labour and exerciſe of the day; but too much indulgence in ſleep has many inconveniencies, both with reſpect to body and mind, as it blunts the ſenſes, and encourages the fluids to ſtagnate in the cellular membrane; whence corpulency, and its neceſſary conſequences languor and weakneſs.

The proper time for ſleep is the night ſeaſon, when

dardneſs

Means of preserving Health.

darkness and silence naturally bring it on: therefore day-sleep in general is not so refreshing; and to some people is really distressful, as creating an unusual giddiness and languor, especially in persons addicted to literary pursuits. Custom, however, frequently renders sleep in the day necessary; and in those constitutions where it is found to give real refreshment, it ought to be indulged.

With regard to the general regimen of diet, it has always been held as a rule, that the softer and milder kinds of aliment are most proper for children and younger subjects; that grown persons should eat what is more substantial; and old people lessen their quantity of solid food, and increase that of their drink.

Means of preserving Health.

INDEX.

Gonor-

Medicines || Medicis.

MEDICINES, whatever substances serve to restore health.—Medicines are either *simple* or *compound*; the former being prepared by nature alone; and the latter owing to the industry of man, by variously mixing the simple together. See PHARMACY.

MEDICINES are likewise distinguished from the manner of using them, into *external* and *internal*; and with regard to their effects, they are said to be *emetic*, *cathartic*, *astringent*, &c. See *MATERIA Medica*.

Pocket MEDICINES, in surgery, those which a surgeon ought always to carry about with him, in a box or convenient case.

Those, according to Heister, are the common digestive ointment, and some detergent ointment, for cleansing and digesting foul ulcers; to which must also be added a plaster or two fitted for defence or adhesion, since one or other of these is almost constantly wanted. Neither should there be wanting a piece of blue vitriol for the taking down luxuriant flesh, and to stop hemorrhagies: but if vitriol is wanting, burnt alum, red precipitate, the infernal stone, or any other corrosive medicine, will supply its place in corrosive intentions; and the last will also serve to open abscesses, to make issues, and perform many other operations of that kind.

With these there should always be kept in readiness also a quantity of scraped lint, that the surgeon may be able to give immediate assistance to wounded persons; since, if he is unprepared for this, they may easily be taken off by an hemorrhagy; a circumstance which ought also to prevail with him to be always provided with suitable bandages.

MEDICIS (Cosmo de), called the *Elder*, son of John de Medicis, was born at Florence Sept. 1389. Altho' in a private station, he appeared with the splendor of the most powerful sovereign; and his fortune, accumulated by successful commerce, was surpassed by the revenue of few princes. He was partial to the sciences, and liberal to men of genius. His library consisted of a vast number of books of his own collecting, and he enriched it with many scarce and valuable manuscripts. Banished from his native country by the envy which his riches inspired, he went to Venice, where he was received with the honours due to a sovereign prince. His countrymen soon perceived their error, and recalled him from banishment. For 34 years he was supreme judge of the republic; and his advice was solicited by the greater part of the cities and sovereignties of Italy. This great man died August 1464, in the 75th year of his age, full of happiness and glory. On his tombstone he is styled, "*Father of the people, and deliverer of his country.*"

Medicis.

MEDICIS (Laurence de), styled the *Great* and the *Father of learning*, was born A. D. 1448. He was the son of Peter, the grandson of Cosmo, and the brother of Julian de Medicis. These two brothers, who were in possession of absolute power at Florence, excited the jealousy of Ferdinand of Naples and Pope Sextus IV. The first hated them, because they had ruined his influence in Florence; and the second, because they opposed the advancement of his nephew. It was at their instigation that the Pazzi conspired against them. Julian was murdered while he heard mass April 26th 1478; and Laurence, who was only wounded, was carried back to his house in the midst of the shouts and acclamations of the people. Heir to the greater part of his grandfather's virtues, he was, like him, the Mæcenas of his age. It was equally astonishing (says an historian of that country) and foreign to our manners, to see the same man engaged in commerce, and supporting the burden of the public affairs; conversing with factors, and receiving ambassadors; giving shows to the people; affording an asylum to the unfortunate; and adorning his country with many magnificent buildings. He was so much beloved by the Florentines, that they appointed him chief magistrate of the republic. By his unbounded liberality, he drew to his court a great number of learned men. He sent John Lascaris into Greece to recover manuscripts, with which he enriched his library. He cultivated learning himself, and was the author of the following works: 1. *Des Poesies Italienes*, Venice, 1554, 12mo. 2. *Canzonne à ballo*, 1568, 4to. 3. *La Compagnia del Mantellaccio Beoni*, with the sonnets of *Burchiello*,

Medicis. *Burchiello*, 1558 or 1568, 8vo. Laurence de Medicis was so universally admired, that the princes of Europe did him the honour to appeal their differences to his decision. It is even reported, that Bajazet emperor of the Turks, to show him a mark of esteem and regard, caused search, for the murderers of his brother Julian in Constantinople, and sent back one of them who had concealed himself in that city. Pope Sixtus IV. was the last of his enemies; but he opposed him with so much ability, that he brought him to terms of accommodation. This illustrious man died April 9th 1492, aged 44. His reputation was sullied by his passion for women and by his infidelity. His two sons, Peter who succeeded him and who was expelled from Florence in 1494, and John who went by the name of Pope Leo X. were like their father remarkable for their generosity and their love of learning. Peter died in 1594, leaving Laurence, the last male issue of this branch. Laurence was the father of Catharine de Medicis, who married Henry II. king of France.

Medicis (John de), on account of his bravery and knowledge in military affairs was surnamed the *Invincible*. He was the son of John, otherwise called *Jourdain*, de Medicis. His only son Cosmo I. styled the *Great*, was chosen duke of Florence after the murder of Alexander de Medicis, A. D. 1537. He first carried arms under Laurence de Medicis against the duke of Urbino, afterwards under Pope Leo X. Upon the death of Leo, he entered into the service of Francis I. which he quitted to follow the fortunes of Francis Sforza duke of Milan. When Francis I. formed an alliance with the pope and the Venetians against the emperor, he returned to his service. He was wounded in the knee at Governola, a small town in the Mantuan territory, by a musket-ball; and being carried to Mantua, he died the 29th of November 1526, aged 28. Brantome relates, that when his leg was to be cut off, and when he was informed that he needed some person to support him, "Proceed without fear (said he), I need nobody!" and he held the candle himself during the operation. This anecdote is also mentioned by Varchi. John de Medicis was above the middle stature, strong, and nervous. His soldiers, to express their affection for him and their concern for his loss, assumed a mourning dress and standards, which gave the name of *the black band* to the Tuscan troops whom he commanded.

Medicis, (Laurence, or Laurenein de), was descended from a brother of Cosmo the Great, and affected the name of *popular*. In 1537, he killed Alexander de Medicis, whom Charles V. had made duke of Florence, and who was believed to be the natural son of Laurence de Medicis duke of Urbino. He was jealous of Alexander's power, and disguised this jealousy under the specious pretext of love to his country. He loved men of learning, and cultivated literature. His works are, 1. *Lamenti*, Modena, 12mo. 2. *Accidosio Commedia*, Florence 1595, 12mo. He died without issue.

Medicis, (Hypolitus de), natural son of Julian de Medicis and a lady of Urbino, was early remarkable for the brilliancy of his wit and the graces of his person. Pope Clement VII. his cousin, made him cardinal in 1529, and sent him as legate into Germany to the court of Charles V. When that prince went into Italy, Medicis, yielding to his warlike disposition, appeared in the dress of an officer, and advanced before the emperor, followed by several respectable gentlemen of the court. Charles, naturally suspicious, and afraid that the legate intended to do him some ill offices with the pope, sent after him and caused him to be apprehended. But when he understood that it was a mere sally of humour in the young cardinal, he set him at liberty in a few days. The character which Medicis obtained by the happy success of this appointment, was of essential service to him. He was considered as one of the supports of the Holy See; and a little before Clement's death, when the corsair Barbarossa made a descent into Italy to the great terror of Rome, which was only defended by 200 of the pope's guards, Medicis was dispatched to protect the coasts from the fury of the barbarians. On his arrival at the place of destination, he was fortunate enough to find that Barbarossa had withdrawn himself at that critical moment; which allowed him to claim the honour of the retreat without exposing his person or his army. When he returned to Rome, he was of great service in the election of Paul III. who nevertheless refused to make him legate to Ancona, though that office had been promised to him in the conclave. Enraged also that the pope had bestowed the principality of Florence on Alexander de Medicis, supposed to be the natural son of Laurence duke of Urbino, he was prompted by his ambition to believe that he might succeed to that dignity by the destruction of Alexander. He entered into a conspiracy against him, and determined to carry him off by a mine; but the plot was discovered before he had accomplished his purpose. Octavian Zanga, one of his guards, was arrested as his chief accomplice. Hypolitus de Medicis, apprehensive for his own safety, retired to a castle near Trivoli. On his road to Naples, he fell sick at Itri in the territory of Fondi, and died August 13th 1535, in his 24th year, not without suspicion of being poisoned. His house was an asylum for the unfortunate, and frequently for those who were guilty of the blackest crimes. It was open to men of all nations; and he was frequently addressed in 20 different languages. He had a natural son named *Asdrubal de Medicis*, who was a knight of Malta. This anecdote proves that his manners were more military than ecclesiastic. He wore a sword, and never put on the habit of cardinal except on occasions of public ceremony. He was wholly devoted to the theatre, hunting, and poetry.

Medicis, (Alexander de), first duke of Florence in 1530, was natural son of Laurence de Medicis surnamed the *Younger*, and nephew of pope Clement VII. He owed his elevation to the intrigues of his uncle and to the arms of Charles V. This prince having made himself master of Florence after an obstinate siege, conferred the sovereignty of this city on Alexander, and afterwards gave him in marriage Margaret of Austria his natural daughter. According to the terms of capitulation granted to the Florentines, the new duke was to be only hereditary doge, and his authority was tempered by councils; which left them at least a shadow of their ancient liberty. But Alexander,

Medicis.

Alexander, who felt himself supported by the emperor and the pope, was no sooner in possession of his new dignity, than he began to govern like a tyrant; being guided by no law but his own caprice, indulging the most brutal passions, and making light of dishonouring families, and of violating even the asylum of the cloisters to gratify his lust. Among the confidants of his debauchery was a relation of his own, Laurence de Medicis. This young man, who was only 22 years of age, at the instigation of Philip Strozzi, a zealous republican, conceived the design of assassinating Alexander, and thereby of delivering his country from oppression. From the moment when he first became attached to him, he tried to gain his confidence, for no other reason but that he might the better have it in his power to take away his life. A considerable time elapsed before he found such an opportunity as he desired. At length, under pretence of procuring the duke a *tête à tête* with a lady of whom he was deeply enamoured, he brought him alone and unattended into his chamber, and put him under his bed. He went out, under pretence of introducing the object of his passion; and returned along with an assassin by profession, to whom alone he had entrusted his design, only to stab him. This cruel scene happened on the night betwixt the 5th and 6th of January 1537. Alexander was only 26 years of age. The Florentines derived no advantage from this crime of Laurence, for they failed in their attempt to recover their liberty. The party of the Medicis prevailed, and Alexander was succeeded by Cosmo; whose government, it must be confessed, was as just and moderate, as that of his predecessor had been violent and tyrannical. Laurence de Medicis fled to Venice, to some of the leaders of the malcontents at Florence, who had taken refuge there; but not thinking himself in sufficient security, he went to Constantinople, whence he returned some time after to Venice. He was there assassinated in 1547, ten years after the duke's murder, by two soldiers, one of whom had formerly been in Alexander's guards: And these soldiers were generous enough to refuse a considerable sum of money, which was the price put upon his head.

Medicis (Cosmo de), grand duke of Tuscany, joined Charles V. against the French, after trying in vain to continue neutral. As a reward for his services, the emperor added to the duchy of Tuscany Piombino the isle of Elba and other states. Cosmo soon after received from pope Pius IV. the title of *grand duke;* and had it not been opposed by all the princes of Italy, this pontiff, who was entirely devoted to Cosmo, because he had thought proper to acknowledge him to be of his house, would, have conferred on him the title of *king*. There never was a more zealous patron of learning. Ambitious of imitating the second Cæsar, he, like him was fond of learned men, kept them near his person, and founded for them the university of Pisa. He died in 1574, at the age of 55, after governing with equal wisdom and glory. In 1562 he instituted the military order of St Stephen. His son, Francis Mary, who died in 1587, was the father of Mary of Medicis the wife of Henry the Great, and of Ferdinand I. who died in 1608.

Medietas linguæ.

MEDIETAS LINGUÆ, in law, signifies a jury, or inquest impanelled, of which the one half are natives of this land and the other foreigners. This jury is never used except when one of the parties in a plea is a stranger and the other a denizen. In petit-treason, murder and felony, foreigners are allowed this privilege; but not in high-treason, because an alien in that case shall be tried according to the rules of the common law, and not by a *medietas linguæ*. A grand jury ought not in any case to be of a *medietas linguæ;* and the person that would have the advantage of a trial in this way, is to pray the same, otherwise it will not be permitted on a challenge of the jurors.

MEDIMNUS, in Grecian antiquity, a measure of Capacity. See MEASURE.

Medina.

MEDINA-TALNARI, a famous town of Arabia Petræa, between Arabia Deserta and Arabia the Happy; celebrated for being the burial-place of Mahomet. It stands at a day's journey from the port of Iambo. It is of moderate size, surrounded by wretched walls, and situated in the midst of a sandy plain. It belongs to the Scherif of Mecca, although it had of late times a particular sovereign of the family of Dacii Barkad. At present, the government is confided by the Scherif to a vizir, who must be taken from the family of the sovereign. Before Mahomet, this city was called *Iathreb;* but it got the name of *Medinet en Nebbi*, "the City of the Prophet," after Mahomet, being driven from Mecca by the Koreischites, had taken refuge there, and passed in it the rest of his days. The tomb of Mahomet at Medina is respected by Mussulmans, but they are under no obligation to visit it for the purposes of devotion. The caravans of Syria and Egypt alone, which on their return from Mecca pass near Medina, go a little out of their way to see the tomb. It stands in a corner of the great square, whereas the Kaba is situated in the middle of that at Mecca. That the people may not perform some superstitious worship to the relics of the prophet, they are prevented from approaching the tomb by grates, through which they may look at it. It consists of a piece of plain mason-work in the form of a chest, without any other monument. The tomb is placed between two others, where the ashes of the two first caliphs repose. Although it is not more magnificent than the tombs of the greater part of the founders of mosques, the building that covers it is decorated with a piece of green silk stuff embroidered with gold, which the pacha of Damascus renews every seven years. It is guarded by 40 eunuchs, who watch the treasure said to be deposited there. It is seated in a plain abounding with palm-trees, in E. Long, 39. 53. N. Lat. 25. See *(History of)* ARABIA.

Medina-Celi, an ancient town of Spain, in Old Castile, and capital of a considerable duchy of the same name; seated near the river Xalon, in W. Long. 2. 9. N. Lat. 41. 15.

Medina-de-las-Torres, a very ancient town of Spain, in Estramadura, with an old castle, and the title of a duchy. It is seated on the confines of Andalusia, at the foot of a mountain near Bajadoz.

Medina-del-Campo, a large rich, and ancient town of Spain, in the kingdom of Leon. The great square is very fine, and adorned with a superb fountain. It is

Medina || Mediolanum.

is a trading place, enjoys great privileges, and is seated in a country abounding with corn and wine. W. Long. 4. 20. Nat. Lat. 41. 22.

Medina-del-rio-Secco, an ancient and rich town of Spain, in the kingdom of Leon, with the title of a duchy seated on a plain, where there are fine pastures. E. Long. 4. 33. N. Lat. 42. 8.

MEDINA (Sir John), a very eminent painter, was son of Medina de L'Asturias, a Spanish captain who had settled at Brussels, where the son was born in 1660. He was instructed in painting by du Chatel; under whose direction he made good progress; and applying himself to the study of Rubens, made that eminent master his principal model. He painted both history and portrait; and was held in an extraordinary esteem by most of the princes of Germany, who distinguished his merit by several marks of honour. He married young, and came into England in 1686, where he drew portraits for several years with great reputation; as he painted those subjects with remarkable freedom of touch, a delicate management of tints, and strong resemblance of the persons. The earl of Leven encouraged him to go to Scotland, and procured him a subscription of 500 l. worth of business. He went, carrying a large number of bodies and postures, to which he painted heads. He returned to England for a short time; but went back to Scotland, where he died, and was buried in the church-yard of the Greyfriers at Edinburgh in 1711, aged 52. He painted most of the Scotch nobility; but was not rich, having 20 children. The portraits of the professors in the surgeon's-hall at Edinburgh were painted by him, and are commended. At Wentworth-castle is a large piece containing the first duke of Argyle and his sons, the two late dukes John and Archibald, in Roman habits; the style Italian and superior to most modern performers. In surgeon's-hall are two small histories by him. The duke of Gordon presented Sir John Medina's head to the great duke of Tuscany for his collection of portraits done by the painters themselves; the duke of Gorden too was drawn by him, with his son the marquis of Huntly, and his daughter Lady Jane, in one piece. Medina was knighted by the duke of Queensberry, lord high commissioner; and was the last knight made in Scotland before the union. The prints in the octavo edition of Milton were designed by him; and he composed another set for Ovid's Metamorphosis, but they were never engraved.

MEDINE, an Egyptian piece of money, of iron silvered over, and about the size of a silver threepence.

MEDIOLANUM, an ancient city, the capital of the Insubres, built by the Gauls on their settlement in that part of Italy. A *municipium*, and a place of great strength. The seat of the liberal arts; when it had the name of *Novæ Athenæ*. Now *Milan*, capital of the Milanese, situated on the rivers Olana and Lombro, E. Long. 9. 30. N. Lat. 45. 25.

Mediolanum Aulercorum (anc. geog.), a town of Gallia Celtica, which afterwards took the name of the *Eburovicum Civitas* (Antonine); corrupted to *Civitas Ebroicorum*, and this last to *Ebroica*; whence the modern appellation *Evreux*, a city of Normandy. E. Long. 1. 12. N. Lat. 49. 21.

Mediolanum Gugernorum (anc. geog.), a town of Gallia Belgica; now the village *Moyland*, not far from Cologne.

Mediolanum Ordovicum (anc. geog.), a town of Britain, now *Llan Vethlin*, a market-town in Montgomery in Wales.

Mediolanum Santonum (anc. geog.), which afterwards taking the name of the people, was called *Santonica Urbs*; also *Santones* and *Santoni*: A town of Aquitain. Now *Saintes*, capital of Saintonge in Guienne, on the river Charente.

Mediomatrici || Meditullium.

MEDIOMATRICI, anciently a territory of Belgica. Now the diocese of Metz.

MEDITATION, an act by which we consider any thing closely, or wherein the soul is employed in the search or consideration of any truth. In our religion, it is used to signify a consideration of the objects and grand truths of the Christian faith.

Mystic divines make a great difference between *meditation* and *contemplation*: the former consists in discursive acts of the soul, considering methodically and with attention the mysteries of faith and the precepts of morality; and is performed by reflections and reasonings, which leave behind them manifest impressions on the brain. The pure contemplative have no need of meditation, as seeing all things in God at a glance, and without any reflection. When a man, therefore, has once quitted meditation, and is arrived at contemplation, he returns no more; and, according to Alvarez, never resumes the oar of meditation, except when the wind of contemplation is too weak to fill his sails.

MEDITERRANEAN, something inclosed within land; or that is remote from the ocean.

Mediterranean is more particularly used to signify that large sea which flows between the continents of Europe and Africa, entering by the straits of Gibraltar, and reaching into Asia, as far as the Euxine Sea and the Palus Mæotis.

The Meditterranean was anciently called the *Grecian Sea* and the *Great Sea*. It is now cantoned out into several divisions, which bear several names. To the west of Italy it is called the *Ligustic* or *Tuscan Sea*; near Venice, the *Adriatic*; towards Greece, the *Ionic* and *Ægean*; between the Hellespont and the Bosphorus, the *White Sea*, as being very safe; and beyond, the *Black Sea*, its navigation being dangerous.

The British trade carried on by means of the Meditterranean Sea is of the last consequence to Great Britain; and the permanent preservation therefore depends on the possession of the town and fortification of Gibraltar.

The counterfeiting of Mediterranean passes for ships to the coast of Barbary, &c. or the seal of the admiralty office to such passes, is felony without benefit of clergy. Stat. 4 Geo, II. c. 18.

MEDITRINALIA, a Roman festival in honour of the goddess Meditrini, kept on the 30th of September. Both the deity and the festival were so called a *medendo*, because on this day they began to drink new wine mixed with old by way of medicine. The mixture of wines, on this festival, was drank with much form and solemn ceremony.

MEDITULLIUM, is used by anatomists for that spungy

Medium || Medusa.

ſpungy ſubſtance between the two plates of the *cranium*, and in the interſtices of all laminated bones. See Anatomy. n° 1, 11.

MEDIUM, in logic, the mean or middle term of a ſyllogiſm, being an argument, reaſon or conſideration, for which we affirm or deny any thing; or, it is the cauſe why the greater extreme is affirmed or denied of the leſs in the concluſion.

Medium, in arithmetic, or *arithmetical medium* or *mean*, called in the ſchools *medium rei;* that which is equally diſtant from each extreme, or which exceeds the leſſer extreme as much as it is exceeded by the greater, in reſpect of quantity, not of proportion; thus 9 is a medium betwixt 6 and 12.

Geometrical Medium, called in the ſchools *medium perſonæ*, is that where the ſame ratio is preſerved between the firſt and ſecond as between the ſecond and third terms; or that which exceeds in the ſame ratio or quota of itſelf, as it is exceeded: thus 6 is a geometrical medium between 4 and 9.

Medium, in philoſophy, that ſpace or region thro' which a body in motion paſſes to any point: thus æther is ſuppoſed to be the medium through which the heavenly bodies move; air, the medium wherein bodies move near our earth; water, the medium wherein fiſhes live and move; and glaſs is alſo a medium of light, as it affords it a free paſſage. That denſity or conſiſtency in the parts of the medium, whereby the motion of bodies in it is retarded, is called the *reſiſtance of the medium;* which, together with the force of gravity, is the cauſe of the ceſſation of the motion of projectiles.

Subtile or *Ætherial* Medium. Sir Iſaac Newton conſiders it probable, that, beſide the particular aereal medium, wherein we live and breathe, there is another more univerſal one, which he calls an *ætherial medium;* vaſtly more rare, ſubtile, elaſtic, and active, than air; and by that means freely permeating the pores and interſtices of all other mediums, and diffuſing itſelf through the whole creation; and by the intervention hereof he thinks it is that moſt of the great phenomena of nature are effected. See Æther, Electricity, Fire, &c.

Medium, in optics, any ſubſtance through which light is tranſmitted.

MEDLAR, in botany. See Mespilus.

MEDULLA ossium, or *Marrow of the Bones*. See Anatomy, n° 5.

Medulla cerebri and *cerebelli*, denotes the white ſoft part of the brain and cerebellum, covered on the outſide with the cortical ſubſtance, which is of a more dark or aſhy colour. See Anatomy, n° 131—133.

Medulla oblongata, is the medullary part of the brain and cerebellum, joined in one; the fore-part of it coming from the brain, and the hind-part from the cerebellum. See Anatomy, n° 134.

It lies on the baſis of the ſkull, and is continued thro' the great preforation thereof into the hollow of the vertebræ of the neck, back, and loins; though only ſo much of it retains the name *oblongata* as is included within the ſkull. After its exit thence, it is diſtinguiſhed by the name of *medulla ſpinalis*. *Ibid.* n° 135.

MEDUSA (fab. hiſt.), one of the three Gorgons, daughter of Phorcys and Ceto. She was the only one of the Gorgons who was ſubject to mortality. She is celebrated for her perſonal charms and the beauty of her locks. Neptune became enamoured of her, and obtained her favours in the temple of Minerva. This violation of the ſanctity of the temple provoked Minerva; and ſhe changed the beautiful locks of Meduſa, which had inſpired Neptune's love, into ſerpents, the ſight of which turned the beholders into ſtones: but Perſeus, armed with Mercury's ax with which he killed Argus, cut off Meduſa's head, from whoſe blood ſprang Pegaſus and Chryſaor, together with the innumerable ſerpents that infeſt Africa. The conqueror placed Meduſa's head on the ægis of Minerva, which he had uſed in his expedition; and the head ſtill retained the ſame petrifying powers as before.

Medusa, in zoology, a genus of vermes, belonging to the order of molluſca. The body is gelatinous, roundiſh, and depreſſed; and the mouth is in the centre of the under part of the body. Many ſpecies, on being handled, affect with a nettle-like burning, and excite a redneſs. The ancients, and ſome of the moderns, add that they have an aphrodiſiac property, and in ſeveral languages they are called by an obſcene name. They were known to the Greek and Romans by the names of Πνευμα Θαλασσιον, and *pulmo marinus*, or ſea-lungs. They attributed medicinal virtues to them. Dioſcorides informs us, that, if rubbed freſh on the diſeaſed part, they cured the gout in the feet, and kibed heels. Ælian ſays, that they were depilatory; and, if macerated in vinegar, would take away the beard. Their phoſphoric quality is well known; nor was it overlooked by the ancients. Pliny obſerves, that if rubbed with a ſtick it will appear to burn, and the wood to ſhine all over. The ſame naturaliſt obſerves, that when they ſink to the bottom of the ſea, they portend a continuance of bad weather.

On Plate CCXCIV, are figured ſeveral ſpecimens, viz. 1. The aurita, or aurited meduſa; which appears, as floating on the water, to be a mere lifeleſs lump of jelly. It is of a whitiſh colour, with a caſt of bluiſh grey, and is of an orbiculated figure, elevated into a convexity in the middle on the upper ſide, flat on the under, and furniſhed with a fringe of fine and ſomewhat rigid filaments round the edge, reſembling white hairs: on the under ſurface there are four cavities near the centre, each of an arcuated figure, and ſurrounded with an opaque line, formed of about 24 parallel points or dots: from the very centre of the under ſide there ariſe four crooked appendages, which have each a row of hairy filaments on the exterior edge; and on the upper ſurface there is an appearance of fine veſſels of a pale colour. This ſpecies is frequent, floating on the ſurface of the ſea, or adhering to rocks about our own coaſts; and when the ſun-ſhines on them, they have a very beautiful lucid appearance. It is called by ſome the *ſea nettle*, it being one of thoſe animals that when touched occaſions a very diſagreeable tingling in the hands. 2. The capillata, or capillated meduſa, is a very ſingular and odd animal: it ſeems a mere lump of a whitiſh ſemi-pellucid jelly; and is as eaſily broken and deſtroyed by a touch as the common jellies brought to our tables: its ſhape is rounded, riſing into a convexity in the middle, where it is therefore thickeſt, and whence it becomes gradually thinner to the ſides: on the under ſide it is plain, and on this there is viſible a rough, or as it were echinated circle, within which there

Meduſa.

Fig. 3. n° 1.

Ibid. 3. n° 2.

Medusa, Medway.

there run eight pairs of rays from the centre toward the circumference; and from the centre there arise also a number of curled appendages, which are sometimes reddish, but more usually whitish, and a vast number of slender filaments: the edge or the circumference of the body is regularly divided into eight portions, and each of them is emarginated, so that on the whole verge there are 16 sinuses. This species is to be met with in vast abundance floating on the surface of the water about Sheppy island in Kent, England, and elsewhere on that coast: great quantities of it are destroyed by being thrown on shore with the waves, whence it has no power of getting off again; and in the open seas, many fish skim near the surface, and prey on them. This is the species called by many authors *pulmo marinus*, on the sea lungs. 4. The marsupialis, or purse medusa, is semi-oval, with four tentacula on the edge. It inhabits the Mediterranean. 4. The waved medusa, has the edges waved, with the fangs on the projecting parts; four orifices beneath, between which rises a stem divided into eight large ragged tentacula.

Fig. 3, n° 3.

Ibid. n° 4.

These animals swim in large companies in search of food, with their tenatcula in continual motion, with which they seize their prey, and convey it to their mouths: they vary in size, the largest being generally about eight inches in diameter. They vary likewise in the number of their tentacula; some having only two, others four, six, and some eight, but they rarely exceed that number. So powerful is their embrace, that whatever prey comes within their reach never escapes. They subsist on insects, small fish, &c.

Mr Banks, in his passage from Madeira to Rio de Janeiro, discovered a new species, which, when brought aboard by the casting net, had the appearance of metal violently heated, and emitted a white light. With these animals were taken small crabs of three different species, altogether new, each of which gave as much light as the glow-worm, though the creature was not so large by nine-tenths. These luminous animals are one of the causes of that appearance to the sea which has been mentioned by many navigators, and of which various reasons have been assigned. It appeared to emit flashes of light exactly resembling those of lightning, only not so considerable, but so frequent, that sometimes eight or ten were visible at the same moment.

MEDWAY, a river of England, rises in the Weald of Sussex, and entering Kent near Ashurst runs by Tunbridge, and thence continues its course towards Maidstone. It is navigable for large ships to Rochester bridge, and thence for vessels and barges to Maidstone, the tide flowing up to that town. The distance between the mouth of this river, where the fort at Sheerness is erected, and Rochester bridge, is between 16 and 18 miles. In this part of the river, the channel is so deep, the banks so soft, and the reaches so short, that it is one of the best and safest harbours in the world; and ships of 80 guns ride a-float at low-water, within musket-shot of Rochester-bridge. Nor is there a single instance upon record, that any of the British navy ever suffered here by storms, except in the dreadful tempest which happened in November 1703, when the Royal Catharine was driven on shore, where she sunk and was lost. On the shore of this river are two castles, one at Upnor, which guards two reaches of the river, and is supposed to defend all the ships which ride above, between that and the bridge; on the other side of the river is Gillingham castle, built for the same purpose, and well furnished with cannon which commands the river. Besides these, there is a platform of guns at a place called the Swam, and another at Cockham-wood. But the principal fortification on this river is the castle at Sheerness.

Meeren || Magalesia

MEEREN, or MEER, (John Vander,) called the *Old*, an esteemed painter, was born in 1627; but the master under whom he learned the art of painting, is not mentioned. His genius directed him to choose for his subjects sea-pieces, landscapes, and views of the sea and its shores; which he painted with great truth, as he had accustomed himself to sketch every scene after nature. The situations of his landscapes, are agreeably chosen, frequently they are solemn, and generally pleasing. The forms of his trees are easy and natural, his distances well observed, and the whole scenery has a striking effect, by a happy opposition of his lights and shadows. He also very often painted battles in such a stile as met with approbation; as they showed good composition, were touched with spirit, and had a great deal of transparence in the colouring. But the fault imputable to Vander Meer is, that in some of his pictures the back-grounds are a little too blue, and that some of his landscapes have a tint which appears rather too yellowish. He died in 1690.

MEEREN, or *MEER*. (John Vander), called *De Jonghe*, an eminent landscape-painter, is supposed to have been the son of the old John Vander Meer, and of whom he learned the first rudiments of the art; but being in his youth deprived of his instructor before he had made any great progress, he became a disciple of Nicholas Bergham, and was accounted the best of those who were educated in the school of that admired master. In the manner of his master, he painted landscapes and cattle; and his usual subjects are cottages, with peasants at their rural occupations and diversions. It is observed of him, that he very rarely introduced cows, horses, or any other species of animals, except goats and sheep; the latter of which are so highly finished, that one would imagine the wool might be felt by the softness of its appearance. His touch is scarce perceptible, and yet the colours are admirably united. He died in 1688. The genuine works of this Vander Meer bear a very high price, and are esteemed even in Italy, where they are admitted into the best collections; but the scarcity of them has occasioned many moderate copies after his works to be passed on the undiscerning for originals.

MEGALE POLIS, (anc. geog.) dividedly (Ptolemy, Pausanius); or conjunctly *Megalopolis*. (Strabo): A town of Arcadia, built under the auspices of Epaminondas; after the battle of Leuctra; many inconsiderable towns being joined together in one great city the better to withstand the Spartans. It was the greatest city of Arcadia, according to Strabo.

MAGALESIA, and MEGALENSES LUDI, feasts and games in honour of Cybele or Rhea the mother of the gods, kept on the 12th of April by the Romans, and famous for great rejoicings and diversions of various sorts. The Galli carried the image of the goddess along the city, with sound of drums and other music,

Megara.

music, in imitation of the noise they made to prevent Saturn from hearing the cries of his infant son Jupiter, when he was disposed to devour him.

MEGARA (anc. geog.), a noble city, and the capital of the territory of Megaris, which for many years carried on war with the Corinthians and Athenians. It had for some time a school of philosophers, called the *Megarici*, successors of Euclid the Socratic, a native of Megara. Their dialect was the Doric; changed from the Attic, which it formerly had been, because of Peleponnesian colonists who settled there.

Megara was situated at a distance from the sea. Its port was called *Nisæa*, from Nisus son of Pandion the second, who obtained the Megaris for his portion, when the kingdom of Athens was divided into four lots by his father. He founded the town, which was eighteen stadia or two miles and a quarter from the city, but united with it, as the Piræus with Athens, by long walls. It had a temple of Ceres. "The roof (says Pausanias) may be supposed to have fallen through age." The site (as Dr Chandler informs us †) is now covered with rubbish, among which are standing some ruinous churches. The place has been named from them *Dode Ecclesiais*, "The Twelve Churches;" but the number is reduced to seven. The acropolis or citadel, called also *Nisæa*, was on a rock by the sea-side. Some pieces of the wall remain, and a modern fortress has been erected on it, and also on a lesser rock near it.

†Travels in Greece, 192

The village Megara (continues the Doctor) consists of low mean cottages, pleasantly situated on the slope of a brow or eminence indented in the middle. On each side of this vale was an acropolis or citadel; one named Caria; the other from Alcathous, the builder of the wall. They related, that he was assisted by Apollo, who laid his harp aside on a stone, which, as Pausanias testifies, if struck with a pebble returned a musical sound. An angle of the wall of one citadel is seen by a wind-mill. The masonry is of the species called Incertum. In 1676 the city-wall was not entirely demolished, but comprehended the two summits, on which are some churches, with a portion of the plain toward the south. The whole site, except the hills, was now green with corn, and marked by many heaps of stones, the collected rubbish of buildings. A few inscriptions are found, with pedestals fixed in the walls and inverted; and also some maimed or mutilated statues. One of the former relates to Atticus Herodes, and is on a pedestal which supported a statue erected to him when consul, A. D. 143. by the council and people of Megara, in return for his benefactions and good-will toward the city. In the plain behind the summits, on one of which was a temple of Minerva, is a large basin of water, with scattered fragments of marble, the remains of a bath or of a fountain, which is recorded as in the city, and remarkable for its size and ornaments, and for the number of it columns. The spring was named from the local nymphs called Sithnides.

The stone of Megara was of a kind not discovered any where else in Hellas; very white, uncommonly soft, and consisting entirely of cockle-shells. This was chiefly used; and, not being durable, may be reckoned among the causes of the desolation at Megara, which is so complete, that one searches in vain for vestiges of the many public edifices, temples, and sepulchres, which once adorned the city.

Megara was engaged in various wars with Athens and Corinth, and experienced many vicissitudes of fortune. It was the only one of the Greek cities which did not re-flourish under their common benefactor Hadrian; and the reason assigned is, that the avenging anger of the gods pursued the people for their impiety in killing Anthemocritus a herald, who had been sent to them in the time of Pericles. The Athenian generals were sworn on his account to invade them twice a-year. Hadrian and Atticus were followed by another friend, whose memory is preserved by an inscription on a stone lying near a church in the village:—"This too is the work of the most magnificent count Diogenes son of Archelaus, who regarding the Grecian cities as his own family, has bestowed on that of the Megarensians one hundred pieces of gold toward the building of their towers, and also one hundred and fifty more with two thousand two hundred feet of marble towards re-edifying the bath; deeming nothing more honorable than to do good to the Greeks, and to restore their cities." This person is not quite unnoticed in history. He was one of the generals employed by the emperor Anastasius on a rebellion in Lauria. He surprised the capital Claudiopolis, and sustained a siege with great bravery, A. D. 494.

Megara retains its original name. It has been much infested by corsairs; and in 1676 the inhabitants were accustomed, on seing a boat approach in the day time or hearing their dogs bark at night, immediately to secrete their effects and run away. The Vaiwode or Turkish governor, who resided in a forsaken tower above the village, was once carried off. It is no wonder, therefore, that Nisæa has been long abandoned. The place was burned by the Venetians in 1687.

MEGARA (anc. geog.) formerly called *Hybla*, a town towards the east coast of Sicily; extinct in Strabo's time, though the name Hybla remained on account of the excellence of its honey. It was a colony of Megareans from Greece. *Risus Megaricus* denotes a hoarse-laugh.

MEGARIS (anc. geog.), the country of the Megareans, is described as a rough region, like Attica; the mountain called *Oneian* or the Asinine, now *Macriplayi* or "the long Mountain," extending through it toward Bœotia and mount Cithæron. It belonged to Ionia or Attica, until it was taken by the Peloponnesians in the reign of Codrus, when a colony of Dorians settled in it. This territory had Attica to the east, Bœotia to the north and west, and the Isthmus of Corinth to the south.

MEGARIS, a small island in the Tuscan sea, joined to Naples by a bridge. Now called *Castello dell'Ovo*.

MEGASTHENES, a Greek historian in the age of Seleucus Nicanor, about 300 years before Christ. He wrote about the oriental nations, and particularly the Indians. His history is often quoted by the ancients. What now passes as his composition is spurious.

Megara || Megiddo.

MEIGDDO (anc. geog.), a town of Galilee, recited (Joshua xvii. 11.) among the cities of Manasseth, in the tribe of Issachar or Asser, on the west side of Jordan. Famous for the defeat of Ahaziah and Josiah, who perished there (2 Kings xxiii. 29.): near it was an

Meibomius || Melaleuca.

an open plain, fit for drawing up an army in battle array. It was situated to the north, contrary to its position in the common maps. The Canaanites, being tributary to the Israelites, dwelt in it, Joshua xvii.—It was rebuilt by Solomon. 1 Kings ix.

MEIBOMIUS, the name of several learned Germans.—*John Henry Meibomius* was professor of physic at Helmstadt, where he was born, and at Lubec; he wrote the *Life of Mæcenas*, published at Leyden in 4to, 1653, with several other learned works. *Henry*, his son, was born at Lubec in 1638; became professor of physic at Helmstadt; and, besides works in his own profession, published *Scriptores rerum Germanicarum*, 3 vol. folio, 1688; a very useful collection, first begun by his father.—*Marcus Meibomius*, of the same family, published a collection of seven Greek authors who had written upon ancient music, with a Latin version by himself; dedicated to Queen Christina of Sweden, who invited him to her court. But she engaging him one day to sing an air of ancient music, while somebody was ordered to dance to it, the immoderate mirth which this occasioned in the spectators so disgusted him, that he immediately left the court of Sweden. His edition of the Greek mythologists, and notes upon Diogenes Laertius in Menage's edition, show him to have been a man of learning; but he suffered no little raillery for his attempt to correct the Hebrew text of the Bible, by a kind of metre he fancied he had found out in those ancient writings.

MEISSEN, a considerable town of Germany, in the electorate of Saxony, and in the margravate of Misnia, with a castle. It formerly belonged to the bishop, but is now secularized, and the inhabitants are Lutherans. In this place is a famous manufactory of porcelain. E. Long. 13. 33. N. Lat. 51. 15.

MEL, HONEY, in the materia medica. See HONEY.

MELA (Pomponius), an ancient Latin writer, was born in the province of Bætica in Spain, and flourished in the reign of the emperor Claudius. His three books of Cosmography, or *De situ orbis*, are written in a concise, perspicuous, and elegant manner; and have been thought worthy of the attention and labours of the ablest critics. Isaac Vossius gave an edition of them in 1658, 4to, with very large and copious notes. To this edition is added, *Julii Honorii oratoris excerptum cosmographiæ*, first published from the manuscript, and *Æthici cosmographia*. Gronovius afterwards published another edition with illustrations by medals. In his last edition are added five books, *De Geographia*, written by some later author: by Jornandes, as Fabricius conjectures.

MELÆNE, or BLACK FLUX, in medicine. See MEDICINE, n° 409.

MELALEUCA, in botany; a genus of the polyandria order, belonging to the polydelphia class of plants. The calyx is quinquepartite, superior; the corolla pentapetalous; the filaments are very numerous, and collected in such a manner as to form five pencils; there is one style; the capsule is half-covered with the calyx, formed like a berry, and is trivalved and trilocular.—This plant has already been noticed under the article (mispelt) MALALEUCA; where also, by mistake, it was said that there is only one species.—The species are five, natives of India and the South Sea islands. The most remarkable species is the LEUCADENDRON, from a variety of which (the *latifolia*, or broad-leaved leucadendron) the Cajeput oil is obtained: a medicine in very high esteem among the eastern nations, particularly in India. It is said to be obtained by distillation from the fruit of the tree. When brought into this country, it is a liquid of a greenish colour, of a fragrant but at the same time a very peculiar odour, and of a warm pungent taste. Some authors, however, represent this oil as being, when of the best quality, a white or colourless fluid; and it has been said by the authors of the *Dispensatorium Brunsvicense*, when prepared in Europe from the seeds sent from India, to be entirely of this appearance. Hitherto the oleum cajeput has been but litte employed either in Britain or on the continent of Europe; but in India it is used both internally and externally, and is highly extolled for its medical properties. It is applied externally where a warm and peculiar stimulus is requisite; it is employed for restoring vigour after luxations and sprains, and for easing a violent pain in gouty and rheumatic cases, in tooth-ach, and similar affections; but it has been chiefly celebrated as taken internally, and it is particularly said to operate as a very powerful remedy against tympanitic affections.

Melampodium, Melampus.

MELAMPODIUM, a name given to black hellebore. See HELLEBORUS.

MELAMPODIUM, in botany: A genus of the polygamia necessaria order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Composita*. The receptacle is palæaceous and conical; the pappus is monophyllous and valve-like; the calyx pentaphyllous.

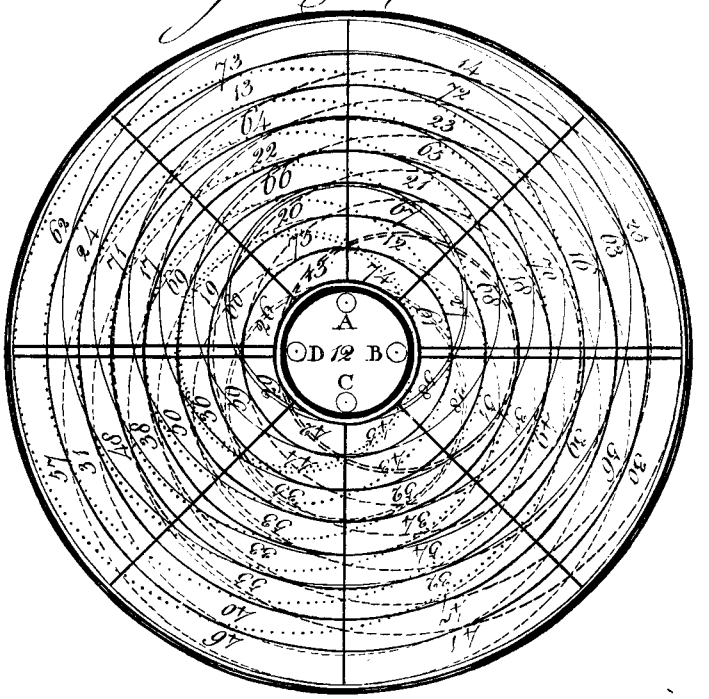
MELAMPUS (fab. hist.), a celebrated soothsayer and physician of Argos, son of Amythaon and Idomenea or Dorippe. He lived at Pylos in Peloponnesus. His servants once killed two large serpents who had made ther nests at the bottom of a large oak; and Melampus paid so much regard to their remains, that he raised a burning pile and burned them upon it. He also took particular care of their young ones, and fed them with milk. Some time after this, the young serpents crept to Melampus as he slept on the grass near the oak, and, as if sensible of the favours of their benefactor, they wantonly played around him, and softly licked his ears. This awoke Melampus, who was astonished at the sudden change which his senses had undergone. He found himself acquainted with the chirping of the birds, and with all their rude notes, as they flew around him. He took advantage of this supernatural gift, and soon made himself perfect in the knowledge of futurity, and Apollo also instructed him in the art of medicine. He had soon after the happiness of curing the daughters of Prœtus, by giving them hellebore, which from that circumstance has been called *melampodium*; and as a reward for his troubles, he married the eldest of these princesses. The tyranny of his uncle Neleus, king of Pylos, obliged him to leave his native country; and Prœtus, to show himself more sensible of his services, gave him part of his kingdom. About this time the personal charms of Pero, the daughter of Neleus, had gained many admirers; but the father promised his daughter only to him who brought into his hands the oxen of Iphiclus. This condition displeased many; but Bias, who was also one of her admirers,

Plate CCXCIV.

Magic Square of Squares.

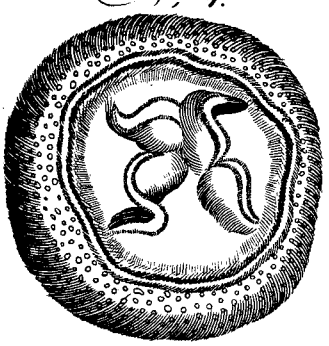
200	217	232	249	8	25	40	57	72	89	104	121	136	153	168	185
38	39	26	7	230	231	218	199	186	167	154	135	122	103	90	71
108	219	230	231	6	27	38	59	70	91	102	123	134	155	166	187
60	37	28	5	252	229	220	197	188	165	156	133	124	101	92	69
201	216	233	248	9	24	41	56	73	88	105	120	137	152	169	184
33	42	23	10	247	234	215	202	183	170	151	138	119	106	87	74
203	214	235	246	11	22	43	54	75	86	107	118	139	150	171	182
53	44	21	12	245	236	213	204	181	172	149	140	117	108	85	76
205	212	237	244	13	20	45	52	77	84	109	116	141	148	173	180
51	46	19	14	243	238	211	206	179	174	147	142	115	110	83	78
207	210	239	242	15	18	47	50	79	82	111	114	143	146	175	178
49	48	17	16	241	240	209	208	177	176	145	144	113	112	81	80
196	221	228	253	4	29	36	61	68	93	100	125	132	157	164	189
62	35	30	3	254	227	222	195	190	163	158	131	126	99	94	67
194	223	226	255	2	31	34	63	66	95	98	127	130	159	162	191
64	33	32	1	250	225	224	193	192	161	160	129	128	97	96	65

Magic Circle of Circles.



Medusa

N.° 1.



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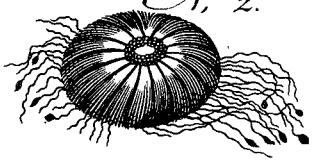
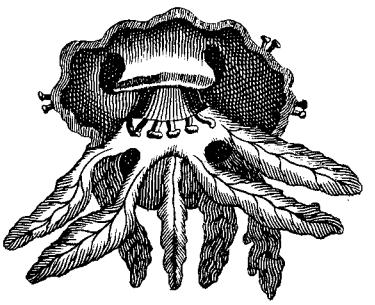
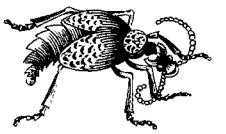


N.° 3.

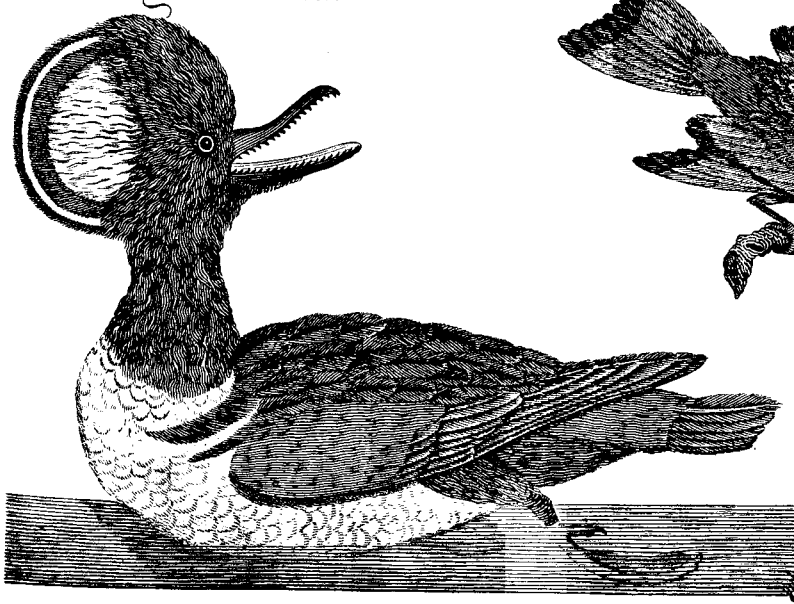
N.° 4.



Meloe.



Mergus cucullatus



Merops, A.

Merops, B.

Thackara & Vallance sc.

Melampyrum || Melancthon.

mirers, engaged his brother Melampus to steal the oxen and deliver them to him. Melampus was caught in the attempt, and imprisoned; and nothing but his services as a soothsayer and physician to Iphiclus would have saved him from death. All this pleaded in the favour of Melampus; but when he had taught the childless Iphiclus how to become a father, he not only obtained his liberty, but also the oxen; and with them he compelled Neleus to give Pero in marriage to Bias. A severe distemper, which had rendered the women of Argos insane, was totally removed by Melampus; and Anaxagoras, who then sat on the throne, rewarded his merit by giving him part of his kingdom, where he established himself, and where his posterity reigned during six successive generations. He received divine honours after death, and temples were raised to his memory.

MELAMPYRUM, COW-WHEAT: A genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 40th order, *Personatæ*. The calyx is quadrifid; the upper lip of the corolla is compressed, with the edges folded back; the capsule is bilocular and oblique, opening at one side; there are two gibbous seeds. There are four species, all of them natives of Britain, and growing spontaneously among corn-fields. They are excellent food for cattle; and Linnæus tells us, that where they abound the yellowest and best butter is made. Their seeds, when mixed with bread, give it a dusky colour; and according to some authors, produce a vertigo, and other disorders of the head; but this is denied by Mr Withering, though he allows that they give it a bitter taste.

MELANCHOLY, a kind of delirium attended with gloomy thoughts, heaviness, and sorrow. See MEDICINE, n° 85, 327.

MELANCTHON (Philip), born at Bretten in the Palatinate in 1495, was one of the wisest and most able men of his age among the Reformers, though of a mild temper, and disposed to accommodate rather than to inflame disputes. In his youth he made an admirable progress in learning, and was made Greek professor at Wirtemberg in 1509. Here his lectures upon Homer, and the Greek text of St Paul's Epistle to Titus, drew to him a great number of auditors, and entirely effaced the contempt to which his low stature and mean appearance had exposed him. Melancthon reduced the sciences to systems; and acquired such reputation, that he had sometimes 2500 auditors. He soon entered into an intimate friendship with Luther, who taught divinity in the same university; and in 1519 they went together to Leipsic, to dispute with Eccius. The following years he was continually engaged in various employments; he composed several books; he taught divinity; took several journeys, in order to found colleges and visit churches; and in 1530 drew up a confession of faith, which goes by the name of the *Confession of Augsburg*, because it was presented to the emperor at the diet held in that city. All Europe was convinced, that he was not, like Luther, backward to accommodate the differences between the various sects of Christians. He hated religious disputes, and was drawn into them only through the necessity of the part he was called to act in the world; and therefore would have sacrificed many things to have produced an union among the Protestants. For this reason, Francis I. the French king, wrote to desire him to come and confer with the doctors of the Sorbonne, in order to agree with them about putting an end to all controversies; but though Luther endeavoured to persuade the elector of Saxony to consent to that journey, and though Melancthon himself desired it, that prince, whether he distrusted Melancthon's moderation, or was afraid of quarrelling with the emperor Charles V. would never grant his permission. The king of England also in vain desired to see him. Melancthon, in 1529, assisted at the conferences of Spires. In 1541, he was at the famous conferences at Ratisbon. In 1543, he went to meet the archbishop of Cologn to assist him in introducing the reformation into his diocese; but that project came to nothing: and in 1548, he assisted at seven conferences on the subject of the interim of Charles V. and wrote a censure on that interim, and all the writings presented at these conferences. He was extremely affected at the dissensions raised by Flaccus Illyricus. His last conference with those of the Roman communion was at Worms, in 1557. He died at Wittemburg in 1560, and was interred near Luther. Some days before he died, he wrote upon a piece of paper the reasons which made him look upon death as a happiness; and the chief of them was, that it "delivered him from theological persecutions." Nature had given Melancthon a peaceable temper, which was but ill suited to the time he was to live in. His moderation served only to be his cross. He was like a lamb in the midst of wolves. Nobody liked his mildness; it looked as if he was lukewarm; and even Luther himself was sometimes angry at it.

Melancthon was a man in whom many good as well as great qualities were wonderfully united. He had great parts, great learning, great sweetness of temper, moderation, contentedness, and the like, which would have made him very happy in any other times but those in which he lived. He never affected dignities, or honours, or riches, but was rather negligent of all these things; too much so in the opinion of some, considering he had a family; and his son-in-law Sabinus, who was of a more ambitious make, was actually at variance with him upon this very article. Learning was infinitely obliged to him on many accounts; on none more than this, that, as already observed, he reduced almost all the sciences which had been taught before in a vague irregular manner, into systems. Considering the distractions of his life, and the infinity of disputes and tumults in which he was engaged, it is astonishing how he could find leisure to write so many books. Their number is prodigious, insomuch that it was thought necessary to publish a chronological catalogue of them in the year 1582. His works indeed are not correct, and he himself owned it: but as he found them useful, he chose rather to print a great number, than to finish only a few; "which however (as Bayle says) was postponing his own glory to the advantage of others." His constitution was very weak, and required great tenderness and management; which made Luther, as hot and zealous as he was, blame him for labouring too earnestly in the vineyard.

MELANIPPIDES,

Melanippides || Melchites.

MELANIPPIDES (fab. hist.), a Greek poet about 520 years before Christ. His grandson of the same name flourished about 60 years after at the court of Perdiccas the Second, of Macedonia. Some fragments of their poetry are still extant.

MELANTERIA, in natural history, a very beautiful fossil, of a dense, compact, and regular texture, and of an extremly bright pale yellow, resembling nothing so much as the purest gold. It is remarkably heavy; and is sometimes found in little irregular masses of the bigness of a pigeon's egg, which are broken with a slight blow: but it is usually met with in the form of a fine gold-coloured efflorescence on vitriolic and pyritical bodies; or in loose, shattery, and friable masses of a more dusky yellow; in which latter state it so much resembles a native sulphur, that it is frequently mistaken for one; however, it is not inflammable; but calcines in the fire to a greyish powder, which by burning longer changes to a deep and fine purple.

The Greeks used it externally as a gentle escharotic and a styptic: they made it an ingredient in their ointments for old ulcers, and used to sprinkle the powder of it on fresh wounds in order to stop the hæmorrhagy.

MELASSES. See MOLASSES.

MELASTOMA, the AMERICAN GOOSEBERRY-TREE, in botany. A genus of the monogynia order, belonging to the decandria class of plants; and in the natural method ranking under the 17th order, *Calycanthemæ*. The calyx is quinquefid and campanulated; the petals are five, inserted into the calyx; the berry is quinquelocular, and wrapped in the calyx.—There are a great many species, all of them natives of the warm parts of America, and very beautiful on account of the variegation of their leaves. Most of the leaves are of two different colours on their surfaces; the under side being either white, gold-coloured, or russet, and their upper parts of different shades of green: so that they make a fine appearance in the hot-house all the year round. There are but few of these plants in the European gardens; which may perhaps have been occasioned by the difficulty of bringing over growing plants from the West Indies; and the seeds being small when taken out from the pulp of their fruits, rarely succeed. The best way is to have the entire fruits put up in dry sand as soon as they are ripe, and forwarded by the quickest contrivance to England. They should be immediately taken out when they arrive, and the seeds sown in pots of light earth, and plunged into a moderate hot-bed of tanner's bark. When the plants come up, and are fit to be removed, they must each be planted in a small pot, and plunged into the tan-bed; and afterwards treated as other exotic plants.

MELCHA, a small village of Barbary, situated about 30 miles from the city of Tunis, built on the ruins of CARTHAGE, some of which are still visible.

MELCHITES, in church-history, the name given to the Syriac, Egyptian, and other Christians of the Levant. The Melchites, excepting some few points of little or no importance, which relate only to ceremonies and ecclesiastical discipline, are in every respect professed Greeks; but they are governed by a particular patriarch, who resides at Damas, and assumes the title of *patriarch of Antioch*. They celebrate mass in the Arabian language. The religious among the Melchites follow the rule of St Basil, the common rule of all the Greek monks. They have four fine convents distant about a day's journey from Damas, and never go out of the cloister.

Melchisedec.

MELCHISEDEC, or MELCHIZEDEK, king of Salem, and priest of the Most High. The scripture tells us nothing either of his father, or of his mother, or of his genealogy, or of his birth, or of his death. And in this sense he was a figure of Jesus Christ, as St Paul affirms, who is a priest for ever, according to the order of Melchisedec, and not according to the order of Aaron, whose original, life, and death, are known. When Abraham returned from pursuing the four confederate kings who had defeated the kings of Sodom and Gomorrah, and had taken away Lot Abraham's nephew along with them (Gen. xiv. 17, 18, 19, &c.), Melchisedek came to meet Abraham as far as the valley of Shaveh, which was afterwards named the king's valley, presented him with the refreshment of bread and wine (or he offered bread and wine in sacrifice to the Lord, for he was a priest of the most high God), and blessed him. Abraham being desirous to acknowledge in him the quality of priest of the Lord, offered him the tythes of all he had taken from the enemy. After this time, there is no mention made of the person of Melchisedec; only the Psalmist (cx. 4.) speaking of the Messiah, says, "Thou art a priest for ever after the order of Melchisedec." St Paul, in his epistle to the Hebrews, unfolds the mystery which is concealed in what is said of Melchisedec in the Old Testament. See Heb. v. 6—10. An infinite number of difficulties and scruples have been started upon the subject of Melchisedec.—St Jerom thought that Salem, of which Melchisedec was king, was not Jerusalem, but the city of Salem near Scythopolis, where they still pretended to show the ruins of the palace of this prince. The greatness and extent of these ruins are a sufficient proof of the magnificence of this ancient building. He thinks it was at this city of Salem or Shalem, that Jacob arrived after his passage over Jordan, at his return from Mesopotamia (Gen. xxxiii. 18.) Some believe that Salem, where Melchisedec reigned, is the same as Salim spoken of in the gospel of St John, chap. iii 23. From the time of Epiphanes there were names invented for the father and mother of Melchisedec. To his father was given the name of Heraclas or Heracles, and to his mother that of Ashtaroth or Astaria. It is generally agreed on by the learned, that when the apostle says, he was "without father and without mother," no more is meant, than that he is introduced into the history of Abraham without acquainting us who he was, or whence he came, where he lived, or when he died. Nevertheless, some have taken St Paul's words literally, and contended that he was not of human but divine nature. Origen and Didymus took him to be an angel; and the author of the *Questions upon the Old and New Testament* pretends, that he was the Holy Ghost, who appeared to Abraham in a human form. The Arabic Catena, upon the ninth chapter of Genesis, makes Melchisedec to be descended from Shem by his father, and from Japheth by his mother.

Melchisedec.

mother. Heraclas or Heraclim his father, was, they say, son or grandson of Phaleg, and son of Heber; and his mother named Salathiel, was daughter of Gomer son of Japheth. Cedrenus and others derive Melchisedec from an Egyptian stock. They say his father was called Sidon or Sida, and was the founder of the city of Sidon the capital of Phœnicia. Suidas says he was of the cursed race of Canaan; for which reason the scripture does not mention his genealogy. The Jews and Samaritans believed Melchisedec to be the same with the patriarch Shem; which opinion has been followed by a great number of modern writers. M. Jurieu has undertaken to prove that he is the same as Cham or Ham. It would be endless to set down all the opinions upon this matter: therefore we shall only add, that Peter Cunæus and Peter du Moulin have asserted, that Melchisedec who appeared to Abraham was the Son of God, and that the patriarch worshipped him and acknowledged him for the Messiah.

About the beginning of the third century arose the heresy of the Melchisedecians, who affirmed that Melchisedec was not a man, but a heavenly power, superior to Jesus Christ: for Melchisedec, they said, was the intercessor and mediator of the angels, but Jesus Christ was so only for men, and his priesthood only a copy of that of Melchisedec, who was the Holy Ghost.

We shall only beg leave to add here one opinon more concerning Melchisedec, which is that of the learned Heidegger, who, as the author of the *Hist. Patriar*, thinks, has taken the right method of explaining the accounts of Moses and the apostle Paul relating to this extraordinary person. He supposes a twofold Melchisedec; the one historical, whereof Moses gives an account in the xivth chapter of Genesis, as that he was king as well as high-priest of Jerusalem; the other allegorical, whom St Paul describes, and this allegorical person is Jesus Christ.

As the history of this prince and priest is so little known, it is no wonder, as Selden observes, that many fabulous accounts have been invented of him; of which the following may suffice as a specimen. Eutychus patriarch of Alexandria relates, that the body of Adam having been embalmed according to his order, was deposited in a cave under a mountain of the children of Seth; but that Adam before his death had commanded that they should take away his remains from that place, and transport them to the middle of the earth: that Noah, to follow the orders of his ancestors, had preserved the bodies of Adam and all the patriarchs with him in the ark: that finding himself near his death, he ordered his son Shem to take the body of Adam, to furnish himself with bread and wine for his journey, to take with him Melchisedec the son of Phaleg, and to go to the place in which an angel would show them where to bury the first man: that Noah added this order, "Command Melchisedec to fix his residence in that place, and to live unmarried all his lifetime, because God has chosen him to do service in his presence; command him, that he build no temple, nor shed the blood of birds, nor four-footed beasts, or any other animal; and that he offer no other oblations to God but bread and wine." This is the reason, according to this author, why, Melchisedec, when he met Abraham, brought forth only bread and wine.

Melchisedec, Melcomb-regis.

A Greek author, under the name of Athanasius, relates, that Melchisedec, was the son of an idolatrous king called Melchi and of a queen called Salem.—Melchi, having resolved to offer a sacrifice to the gods, sent his son Melchisedec to fetch him seven calves. In the way the young prince was enlightened by God, and immediately returned to his father, to demonstrate to him the vanity of idols. Melchi, in wrath, sent him back to fetch the victims. While he was absent, the king sacrificed his eldest son, and a great many other children to his gods. Melchisedec returning, and conceiving great horror at this butchery, retired to mount Tabor, where he lived seven years, without clothes, and fed only on wild fruits. At the end of seven years, God appeared to Abraham, bid him go up to mount Tabor, where he should find Melchisedec. He ordered him to cloath him, and to ask his blessing; which Abraham having done, Melchisedec anointed him with oil, and they came down together from the mountain.

MELCOMB-REGIS, a town of Dorsetshire, in England, 130 miles from London, is situated at the mouth of the river Wey, by which it is parted from Weymouth. It appears from the name to have been anciently the king's demesne, and from the records to have paid quit-rent to the crown all along after king Edward I. till it was brought off by the inhabitants before they were united to Weymouth. It lies on the north side of the haven, on a peninsula surrounded by the sea on all sides except on the north. The streets are broad and well paved, and many of the houses large and high. It sent members to parliament in the reign of king Edward I. before Weymouth had that privilege. It was by parliament appointed a staple in the reign of Edward III. In the next reign the French burnt it; and it was thereby rendered so desolate, that the remaining inhabitants prayed and obtained a discharge from customs. On account of its quarrels with Weymouth, in the reign of Henry VI. its privileges as a port were removed to Pool: but in that of queen Elizabeth they were restored to it by act of parliament, which was confirmed in the next reign, on condition that Melcomb and Weymouth should make but one corporation, and enjoy their privileges in common; and to this was owing the flourishing state of both. In the two reigns last mentioned, a wooden bridge with seventeen arches was built from hence to Weymouth; to which, as well as its church, the chief contributors were certain citizens of London; and upon its decay it was rebuilt in 1770. Here is a good market-place and town-hall, to which the members of the corporation of Weymouth come to attend public business, as the inhabitants do to its church for public worship. For several years past the sea has retired from it on the east, the priory, formerly being bounded by the sea; but there is now a street beyond it, from which it is several paces to the high-water-mark. The priory was situated in the east part of the town, in Maiden-street, whose site occupied about an acre, now covered with tenements. On the south side are the remains of the chapel, now converted into a malt-house. Near it are the remains of an ancient

ancient building, formerly a nunnery. Here are three meeting-houses and a work-house for the poor. The church, which is in the middle of the town, has a wooden turret for a bell, and had been an old chapel. It was rebuilt in 1605, and made parochial, and is a handsome fabric, with a beautiful altar-piece painted and given by Sir James Thornhill. The port, which generally goes by the name of Weymouth, is said to be the best frequented in the county, and is defended by Sandford and Portland castles. The markets for both towns are Tuesdays and Fridays, but there are no fairs. Melcomb-regis is reckoned bigger, more thriving, and populous than Weymouth. They are both but one corporation and borough, consisting of a mayor, recorder, two bailiffs, an uncertain number of aldermen, and twenty-four capital burgesses. Whoever has been a mayor is ever after an alderman. They send four burgesses to parliament, who are elected by such as have freeholds, whether they inhabit here or not; and the number of voters is near 700. Every elector, as in London, has the privilege of voting for four persons, who when chosen are returned, in two distinct indentures, as the burgesses of Weymouth and the burgesses of Melcomb-Regis.

MELDÆ (anc. geog.), a town of Gallia Celtica, (called *Meldorum civitas* in the Notitia), on the Matrona. Now *Meaux*, a city in Champaign on the Marne.

MELEAGER (fab. hist.) a celebrated hero, son of Œneus king of Calydonia, by Althæa daughter of Thestius. The parcæ were present at the moment of his birth, and predicted his future greatness. Clotho said that he would be brave and courageous; Lachesis foretold his uncommon strength and valour; and Atropos said that he should live as long as that firebrand which was on the fire remained entire and unconsumed. Althæa no sooner heard this, than she snatched the stick from the fire, and kept it with the most jealous care, as the life of her son totally depended upon its preservation. The fame of Meleager increased with his years; he signalized himself in the Argonautic expedition, and afterwards delivered his country from the neighbouring inhabitants, who made war against his father at the instigation of Diana, whose altars Œneus had neglected. But Diana punished the negligence of Œneus by a greater calamity. She sent a huge wild boar, which laid waste all the country, and seemed invincible on account of its immense size. It became soon a public concern: all the neighbouring princes assembled to destroy this terrible animal; and nothing is more famous in mythological history, than the hunting of the Calydonian boar. The princes and chiefs that assembled, and which are mentioned by mythologists, were Meleager son of Œneus, Idas and Lynceus sons of Apharcus, Dryas son of Mars, Castor and Pollux sons of Jupiter and Leda, Pirithous son of Ixion, Theseus son of Ægeus, Anceus and Cepheus sons of Lycurgus, Admetus son of Pheres, Jason son of Æson, Peleus and Telamon sons of Æacus, Iphicles son of Amphitryon, Eurytrion son of Actor, Atalanta daughter of Schœneus, Iolas the friend of Hercules, the sons of Thestius, Amphiaraus son of Oileus, Protheus, Cometes, the brothers of Altæa, Hippothous son of Cercyon, Leucippus, Adrastus, Ceneus, Phileus, Echion, Lelex, Phœnix son of Amyntor, Panopeus, Hyleus, Hippasus, Nestor, Menœtius the father of Patroclus, Amphicides, Laertes the father of Ulysses, and the four sons of Hippocoon. This troop of armed men attacked the boar, and it was at last killed by Meleager.—The conqueror gave the skin and the head to Atalanta, who had first wounded the animal. This irritated the rest, and particularly Toxeus and Plexippus the brothers of Althæa, and they endeavoured to rob Atalanta of the honourable present. Meleager defended her, and killed his uncles in the attempt. Mean time the news of this celebrated conquest had already reached Calydon, and Althæa went to the temple of the gods to return thanks for the victory which her son had gained: But being informed that her brothers had been killed by Meleager, she in the moment of resentment threw into the fire the fatal stick on which her son's life depended, and Meleager died as soon as it was consumed. Homer does not mention the firebrand; whence some have imagined that this fable is posterior to that poet's age. But he says, that the death of Toxeus and Plexippus so irritated Althæa, that she uttered the most horrible curses and imprecations upon her son's head.

MELEAGER, a Greek poet, the son of Eucrates, was born at Seleucia in Syria, and flourished under, the reign of Seleucus VI. the last king of Syria. He was educated at Tyre; and died in the island of Coos, anciently called *Merope*. He there composed the Greek epigrams called by us the *Anthologia*. The disposition of the epigrams in this collection was often changed afterwards, and many additions have been made to them. The monk Planudes put them into the order they are are in at present, in the year 1380.

MELEAGRIS, in ornithology, the TURKY; a genus of birds belonging to the order of gallinæ. The head is covered with spongy caruncles; and there is likewise a membranaceous longitudinal caruncle on the throat.

There is but one (A) species, *viz.* the gallopavo, or North American turkey of Ray. It has a caruncle both on the head and throat; and the breast of the male is bearded or tufted. He lives upon grain and insects: when the cock struts, he blows up his breast, spreads and erects his feathers, relaxes the caruncle on the forehead, and the naked parts of the face and neck become intensely red. Barbot informs us that very few turkies are to be met with in Guinea, and those only in the hands of the chiefs of the European forts; the negroes declining to breed any on account of their tenderness, which sufficiently proves them not to be natives of that climate. He also remarks, that neither the common poultry nor ducks are natural to Guinea any more than the turky. Neither is that bird a native of Asia: the first that were seen in Persia were brought

(A) Two others were formerly enumerated; but in the late edition of the *Syst. Nat.* by Gmelin, they have been transferred to a new genus. See PENELOPE.

Meleagris, Meles.

brought from Venice by some Armenian merchants. They are bred in Ceylon, but not found wild. In fact, the turky, properly so called, was unknown to the ancient naturalists, and even to the old world, before the discovery of America. It was a bird peculiar to the new continent; and is now the commonest wild-fowl in the northern parts of that country, where they are frequently met with by hundreds in a flock: in the day-time they frequent the woods, where they feed on acorns; and return at night to the swamps to roost, which they do on the trees. They are frequently taken by means of dogs, though they run faster for a time; but the dogs persisting in the pursuit, the birds soon grow fatigued, and take to the highest trees, where they will suffer themselves to be shot one after another if within reach of the marksman. This fowl was first seen in France in the reign of Francis I. and in England in that of Henry VIII. By the date of the reign of these monarchs, the first turkies must have been brought from Mexico, the conquest of which was completed A. D. 1521. Ælian mentions a bird found in India, which some writers have suspected to be the turky; but Mr Pennant concludes with Gesner, that it was either the peacock, or some bird of that genus.

The turky-hen begins to lay early in the spring, and will often produce a great number of eggs, which are white, marked with reddish or yellow spots, or rather freckles. She sits well, and is careful of her young; of which in this climate she will often have from fourteen to seventeen for one brood; but she scarce ever sits more than once in a season, except allured thereto by putting fresh eggs under her as soon as the first set are hatched; for as she is a close sitter she will willingly remain two months on the nest, tho' this conduct, as may be supposed, is said greatly to injure the bird. Turkies are bred in quantities in some of the northern counties of England, and are driven up to London towards autumn for sale in flocks of several hundreds, which are collected from the several cottages about Norfolk, Suffolk, and neighbouring counties, the inhabitants of which think it well worth their while to attend carefully to them, by making these birds a part of their family during the breeding season. It is pleasing to see with what facility the drivers manage them, by means of a bit of red rag fastened to the end of a stick, which, from their antipathy to it as a colour, acts with the same effect as a scourge to a quadruped.

Of the turky there are several varieties, which have arisen from domestication. The most common is *dark grey* inclining to black, or barred dusky white and black. There is also a beautiful variety of a fine deep *copper* colour, with the greater quills pure white, and the tail of a dirty white; it is when old a most beautiful bird. A variety with a *pure white* plumage is also now not unfrequent, and appears very beautiful. It was once esteemed as a great rarity, and the breed supposed originally to have arisen in Holland. In the Leverian Museum is also a common turky, with a large *tuft* of feathers on its head, much resembling one figured by Albin.

MELES, in zoology. See Ursus.

Meles (anc. geog.), a fine river running by the walls of Smyrna in Ionia, with a cave at its head, where Homer is said to have written his poems. And from it Homer takes his original name *Melesigenes*, given him by his mother Critheis, as being born on its banks, (Herodotus.)

Meletians & Melica.

MELETIANS, in ecclesiastical history, the name of a considerable party who adhered to the cause of Meletius bishop of Lycopolis, in Upper Egypt, after he was deposed, about the year 306, by Peter bishop of Alexandria, under the charge of his having sacrificed to the gods, and having been guilty of other heinous crimes; though Epiphanius makes his only failing to have been an excessive severity against the lapsed. This dispute, which was at first a personal difference between Meletius and Peter, became a religious controversy; and the Meletian party subsisted in the fifth century, but was condemned by the first council of Nice.

MELIA, Azaderach, or the *Bead tree*, in botany: A genus of the monogynia order, belonging to the decandria class of plants: and in the natural method ranking under the 23d order *Tribilatæ*. The calyx is quinquedentated: the petals five; the nectarium cylindrical, as long as the corolla, with its mouth ten-toothed: the fruit is a plum with a quinquelocular kernel, There are three species, all of them exotic trees of the Indies, rising near 20 feet high; adorned with large pinnated or winged leaves, and clusters of pentapetalous flowers. They are all propagated by seeds sown on hot-beds.

MELIANTHUS, Honey-flower, in botany: A genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 24th order *Corydales*. The calyx is pentaphyllous, with the lowermost leaf gibbous: there are four petals, with the nectarium under the lowest ones. The capsule is quadrilocular. There are two species. 1. The major hath a thick, ligneous, spreading root; many upright, ligneous, durable stalks, rising six or eight feet high; garnished with large pinnated leaves, of four or five pair of serrated lobes terminated by an odd one; and, from the sides and tops of the stalks, long spikes of chocolate-coloured flowers. 2. The minor hath a root like the former; upright, ligneous, soft, durable stalks, rising four or five feet high; garnished with smaller pinnated leaves; and from the sides and ends of the branches, long, loose, pendulous bunches of flowers tinged with green, saffron colours, and red.—Both the species flower about, June: but rarely produce seeds in this country. They are very ornamental, both in foliage and flower, and merit admittance in every collection. They are easily propagated by suckers and cuttings. They thrive best in a dry soil, and in a sheltered warm exposure.

MELIBOEA (anc. geog.), an island of Syria, at the mouth of the Orontes; which, before it falls into the sea, forms a spreading lake round it. This island was famous for its purple dye. Thought to be a colony of Thessalians; and hence Lucretius's epithet, *Thessalicus*.

MELICA, ropegrass: A genus of the digynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order *Gramina*. The calyx is bivalved, biflorous, with an embryo of a flower betwixt the two florets. There are three species; of which the most remarkable is the

the nutans. It is a native of ſeveral parts of Britain, and the adjacent iſlands; and the inhabitants of ſome of the weſtern iſlands make ropes of it for fiſhing-nets, as it will bear the water for a long time without rotting.

MELICERES, in ſurgery, a kind of encyſted tumors, ſo called when their contents are of the conſiſtence of honey.

MELICERTA, Melicertes, or *Melicertus* (fab. hiſt.), a ſon of Athamas and Ino. He was ſaved by his mother from the fury of his father, who prepared to daſh him againſt a wall as he had done his brother Learchus. The mother was ſo terrified that ſhe threw herſelf into the ſea with Melicerta in her arms. Neptune had compaſſion on the misfortunes of Ino and her ſon. He changed them both into ſea deities. Ino was called *Leucothoe* or *Matuta;* and Melicerta was known among the Greeks by the name of *Palæmon*, and among the Latins by that of *Portumnus*. Some ſuppoſe that the Iſthmian games were inſtituted in honour of Melicerta.

MELILLA, an ancient town of Africa in the kingdom of Fez, and in the province of Garet. It was taken by the Spaniards in 1469, but returned back to the Moors. W. Long. 2. 9. N. Lat. 35. 20.

MELILOT. See Trifolium.

MELINDA, a kingdom on the eaſt coaſt of Africa, ſituated, according to ſome, between the third and fourth degree of ſouth latitude; though there is great diſagreement among geographers as to its extent. It is allowed by all, however, that the coaſts are very dangerous; being full of rocks and ſhelves, and the ſea at ſome ſeaſons very liable to tempeſts. The kingdom of Melinda is for the moſt part rich and fertile; producing almoſt all the neceſſaries of life except wheat and rice, both which are brought thither from Cambaya and other parts; and thoſe who cannot purchaſe them make uſe of potatoes in their ſtead, which are here fine, large, and in great plenty. They likewiſe abound with great variety of fruit-trees, roots, plants, and other eſculents, and with melons of exquiſite taſte. They have alſo great plenty of veniſon, game, oxen, ſheep, hens, geeſe, and other poultry, &c. and one breed of ſheep whoſe tails weigh between 30 and 40 pounds. The capital city is alſo called *Melinda*.

MELINUM, in natural hiſtory, the name of an earth famous in the earlieſt ages of painting, being the only white of the great painters of antiquity; and, according to Pliny's account, one of the three colours with which alone they performed all their works. It is a fine, white, marly earth, of a very compact texture, yet remarkably light; a ſort of texture which muſt render any earth fit for the painter's uſe that is of a proper colour. It is frequently found forming a ſtratum in the earth, lying immediately under the vegetable mould. It is of a very ſmooth but not gloſſy ſurface; is very ſoft to the touch; adheres firmly to the tongue; is eaſily broken between the fingers; and ſtains the ſkin in handling. It melts readily in the mouth, and is perfectly fine; leaving not the leaſt grittineſs between the teeth: thrown into water, it makes a loud bubbling and hiſſing noiſe, and moulders away into a fine powder. It does not ferment with acids; and ſuffers no change in the fire. Theſe are the characters by which the melinum of the ancients is diſtinguiſhed from all other white earths. It is ſtill found in the ſame place from which the painters of old had it, *viz.* The iſle of Milo or Melos, from whence it had its name; and is common in moſt of the adjacent iſlands. It has of late been tried here; but is found not to make ſuch a bright paint as the other ſubſtances now employed. It is not, however, liable, like them, to turn yellow: hence it would ſeem to be worth the conſideration of perſons in the colour-trade; eſpecially as it might be had in any quantities for the carriage.

MELISSA (fab. hiſt.), a daughter of Meliſſus king of Crete, who with her ſiſter Amalthæa fed Jupiter with the milk of goats. She firſt found out the means of collecting honey; whence it has been fabled that ſhe was changed into a bee, as her name is the Greek word for that inſect.

MELISSA, Baum: A genus of the gymnoſpermia order belonging to the didynamia claſs of plants; and in the natural method ranking under the 42d order *Verticillatæ*. The calyx is aired, a little plane above, with the upper lip having its dents nearly of equal height: the upper lip of the corolla is arched and bifid; the under one, with the middle lobe, cordated. There are ſeveral ſpecies; but the moſt remarkable are the following. 1. The officinalis, or common baum, has fibrous perennial roots; many upright, ſquare, branchy, annual ſtalks, riſing two or three feet high: garniſhed with oblong, indented, oppoſite leaves, by pairs, two or three inches long, and half as broad; and from the upper axillas verticillate cluſters of ſmall white flowers upon ſingle footſtalks. There is alſo a kind with variegated leaves. 2. The grandiflora, or Hetrurian calamint, hath fibrous perennial roots and annual ſtalks, riſing about a foot high, garniſhed with oblong, oval, indented, hairy, oppoſite leaves; and from the upper axillas verticillate cluſters of large purple flowers on forked footſtalks. 3. The calamintha, or common calimint of the ſhops, has fibrous perennial roots; upright, ſquare, branchy hairy ſtalks, riſing a foot high; roundiſh, indented, oppoſite leaves; and verticillate cluſters of ſmall bluiſh flowers, on forked footſtalks as long as the flowers. All theſe ſpecies are eaſily propagated by offsets.

Medicinal uſes. The firſt ſpecies, when in perfection, has a pleaſant ſmell, ſomewhat of the lemon kind; and a weak, roughiſh, aromatic taſte. The young ſhoots have the ſtrongeſt flavour: the flowers, and the herb itſelf when old or produced in very rich moiſt ſoils or rainy ſeaſons, are much weaker both in ſmell and taſte. Baum is appropriated, by the writers on the materia medica, to the head, ſtomach, and uterus; and in all diſorders of theſe parts is ſaid to do extraordinary ſervice. So high an opinion have ſome chemiſts entertained of this plant, that they have expected to find in it a medicine which ſhould prolong life beyond the uſual period. The preſent practice, however, holds it in no great eſteem; and ranks it (where it certainly deſerves to be) among the weaker corroborants. Infuſions of the leaves in water ſmell agreeably of the herb, but have not much taſte, though on being inſpiſſated they leave a conſiderable quantity of a bitteriſh auſtere extract. Infuſions of baum do not, like other aromatics, offend

offend the head, as is complained of from ſage, &c. Cold infuſions in water or ſpirit are far better than the cohobated diſtilled water, and are the beſt preparations from the plant. On diſtilling the freſh herb with water, it impregnates the firſt running pretty ſtrongly with its grateful flavour. When large quantities are ſubjected to the operation at once, there ſeparates and riſes to the ſurface of the aqueous fluid a ſmall portion of eſſential oil, which ſome call *ol. Syriæ*, and others *ol. Germanis*. It is of a yellowiſh colour, and of a very fragrant ſmell.

MELISSUS of Samos, a Greek philoſopher, was the ſon of Rhagines and the diſciple of Parmenides; and lived about 440 B. C. He pretended that the univerſe is infinite, immoveable, and without a vacuum. Themiſtocles was among his pupils.

MELITE (anc. geog.), an iſland referred to Africa by Scylax and Ptolemy; but nearer Sicily, and allotted to it by the Romans: commended for its commodious harbours; for a city well built, with artificers of every kind, eſpecially weavers of fine linen; all owing to the Phœnicians the firſt coloniſts. Now *Malta;* remarkable for St Paul's ſhipwreck. See Malta.

Melite, *Melita*, or *Melitina Inſula;* an iſland on the coaſt of Illyricum in the Adriatic. The *Catuli Melitæi* (Pliny) were famous. Now *Melede*, the name of the iſland Samos. See Samos.

Melite (anc. geog.), a town of Ionia, ſtruck out of the number of Ionian towns on account of the arrogance of the people, and Smyrna admitted in lieu of it. The ſituation not ſaid,

MELITENSIS terra, the *Earth of Malta:* an earth of which there are two very different kinds; the one of the genus of boles, the other of the marles. The latter is that known by medicinal authors under this name; the former is the Malta earth now in uſe: but both being brought from the ſame place, are confuſedly called by the ſame name. The Malteſe marle, which is the *terra Melitenſis* of medicinal authors, is a looſe, crumbly, and very light earth, of an unequal and irregular texture; and, when expoſed to the weather, ſoon falls into fine ſoft powder: but when preſerved and dried, it becomes a looſe, light maſs, of a dirty white colour, with a greyiſh caſt: it is rough to the touch, adheres firmly to the tongue, is very eaſily crumbled to powder between the fingers, and ſtains the hands. Thrown into the water, it ſwells, and afterwards moulders away into a fine powder. It ferments very violently with acid menſtruums. Both kinds are found in great abundance in the iſland of Malta, and the latter has been much eſteemed as a remedy againſt the bites of venomous animals. The other has ſupplied its place in the German ſhops; and is uſed there as a cordial, ſudorific, and aſtringent.

MELITO (canonized), biſhop of Sardis in Lydia, in the ſecond century; remarkable for the apology he preſented to the emperor Aurelius, in favour of the Chriſtians; on which Euſebius and the other ancient eccleſiaſtical writers beſtow great praiſes: but that apology and all Melito's other works are loſt.

MELITUS, a Greek orator and poet, the accuſer of Socrates. The Athenians, after the death of Socrates diſcovering the iniquity of the ſentence they had paſſed againſt that great philoſopher, put Melitus to death, 400 B. C.

MELLAN (Claude), an engraver of conſiderable note, was a native of Abbeville in Picardy, and born in 1601. His father was the receiver of the cuſtoms in that town; and he took great care of the education of his ſon. His genius for drawing diſcovering itſelf very early in life, he was ſent to Paris, and placed under the direction of Simon Vouet in order to perfect himſelf in that art, and his ſtudies promiſed ſucceſs; but he was diverted from his application to them by the deſire he had of learning the management of the graver, which he acquired with much facility. From Paris, at the age of ſixteen, he went to Rome; where he engraved a conſiderable number of plates, many of which are held in great eſtimation; particularly thoſe for the Juſtinian Gallery, the portrait of the Marquis Juſtinian, and that of Pope Urban VIII. Returning to France, he married at Paris and ſettled there in 1654. The king of France being made acquainted with his merit, aſſigned him apartments in the Louvre, in the double quality of a painter and an engraver. He acquired a competent fortune, and was greatly eſteemed by all who knew him. He died in 1688, aged 87.

Florent le Comte tells us, "That Charles II. was ſo much pleaſed with his performances, that he invited him to come into England, making him at the ſame time very advantageous offers. But the love of his country (continues that author) prevented his accepting of them."

It is remarked, that moſt of the plates which he engraved at Rome, and before he went thither, are executed in the uſual manner; that is, with parallel ſtrokes, croſſed with ſecond and third ſtrokes, as the depth of the ſhadows might require. But afterwards he adopted a new mode of working with ſingle ſtrokes only, without any ſecond ſtrokes laid upon them; and the ſhadows are expreſſed by the ſame ſtrokes being made ſtronger and brought nearer to each other. The effect which he produced by this method of engraving is ſoft and clear. In ſingle figures and ſmall ſubjects he ſucceeded very happily; but in large compoſitions, where great depth of ſhadow was required, he has failed. His neateſt plates in this ſtyle have an unfiniſhed appearance, by no means ſuitable to large engravings; but at the ſame time a lightneſs exceedingly agreeable when confined to ſmall ones. According to Le Comte, the works of this maſter amount to 342.

MELLER, a lake of Sweden, 80 miles long, and 30 broad; on which ſtands the city of Stockholm.

MELLI, with the country of the Mundingoes, in Africa. The country formerly called *Melli*, now chiefly inhabited by the Mundingoes, who ſtill retain pretty much of the character aſcribed to the people of Melli, lies to the ſouth of the river Gambia; on the weſt it borders on the kingdom of Kabo; on the ſouth it has *Melli*, properly ſo called, and the mountains that part it from Guinea; and on the eaſt it extends to the kingdom of Gago. A great part of this country we are little acquainted with; as is the caſe with regard to moſt of the inland territories of Africa, but towards the ſea-coaſt this country is a little better known.

The firſt place of note we meet with is Kachao, a Portugueſe colony, ſituated on the river of St Domingo, which falls into the ſea about 26 leagues below

this town.—About 26 leagues above Kachao, on the same side of the river, is another trading town called *Farini*, where, in the months of October and November, one may trade for about half the quantity of wax and ivory which is traded for at Kachao. Here are also some slaves to be bought.—Bot is a village near the mouth of the river Gesves, where most of the traders buy rice; which is in a great plenty there, and very good.—Gesves is a village on a river of the same name, on which the Portuguese have a factory. At Gesves one may trade yearly for 250 slaves, 80 or 100 quintals of wax, and as many of ivory. Near the mouth of the river of Gesves is a village called *Kurbali*, where there is a considerable trade for salt; here are also some slaves and ivory. Rio Grande, or the Great River, runs about 10 or 12 leaves to the south of the river of Gesves. About 80 leagues from the mouth of it is a nation of Negroes, who are good traders in ivory, rice, millet, and some slaves. They are called *Analons*. Over-against the mouth of Rio Grande is a cluster of islands called *Bissago Isles*; the most considerable of which is Cassagut, being about six leagues long and two broad; its soil is very good, and produces millet, rice, and all kinds of pulse, besides orange and palm-trees, and many others. This island, with those of Carache, Canabac, and La Gallina, are the only ones where the Europeans may trade with some security. They trade, however, sometimes at the other islands, but they must be extremely cautious; and yet after all their precautions, they will be robbed and murdered if they venture to go ashore. The river Nunho runs 16 leagues to the south of Rio Grande; it is very considerable, and comes from a vast distance in-land. One may buy here 300 quintals of ivory and 100 slaves a-year. Rice grows here admirably well, and is very cheap. There are every-where sugar-canes which grow naturally; and plants of indigo, which might turn to good account. The trade is carried on here from March till August. In the river of Sierra Leone, the late Royal African company of England had, in the year 1728, two islands; the one, called *Tasso*, a large flat island, near three leagues in circumference, in which the company's slaves had a good plantation; the rest of the island is covered with wood, among which are silk-cotton trees of an unaccountable size. The other island is *Bense*, whereon stood a regular fort. It was formerly the residence of one of the English chiefs.

MELMOTH (William, Esq;), a learned and worthy bencher of Lincoln's Inn, was born in 1666. In conjunction with Mr Peere Williams, Mr Melmoth was the publisher of Vernon's Reports, under an order of the court of chancery. He had once an intention of printing his own Reports; and a short time before his death advertised them at the end of those of his coadjutor Peere Williams, as then actually preparing for the press. They have, however, not yet made their appearance. But the performance for which he justly deserves to be held in perpetual remembrance is, "The Great Importance of a Religious life;" concerning which it may be mentioned, to the credit of the age, that notwithstanding many large editions had before been circulated, 42,000 copies of this useful treatise have been sold in the last 18 years. It is a somewhat singular circumstance, that the real author of this most admirable treatise should never before have been publicly known (it having been commonly attributed to the first earl of Egmont, and particularly by Mr Walpole in his Catalogue); which is the more surprising, as the author is plainly pointed out in the following short character prefixed to the book itself; "It may add weight, perhaps, to the reflections contained in the following pages, to inform the reader, that the author's life was one uniform exemplar of those precepts which, with so generous a zeal, and such an elegant and affecting simplicity of style, he endeavours to recommend to general practice. He left others to contend for modes of faith, and inflame themselves and the world with endless controversy: it was the wiser purpose of his more ennobled aim, to act up to those clear rules of conduct which revelation hath graciously prescribed. He possessed by temper every moral virtue; by religion every Christian grace. He had a humanity that melted at every distress; a charity which not only thought no evil, but suspected none. He exercised his profession with a skill and integrity which nothing could equal but the disinterested motive that animated his labours, or the amiable modesty which accompanied all his virtues. He employed his industry, not to gratify his own desires; no man indulged himself less: not to accumulate useless wealth; no man more disdained so unworthy a pursuit: it was for the decent advancement of his family, for the generous assistance of his friends, for the ready relief of the indigent. How often did he exert his distinguished abilities, yet refuse the reward of them, in defence of the widow, the fatherless, and him that had none to help him! In a word, few have ever passed a more useful, not one a more blameless life; and his whole time was employed either in doing good or in meditating it. He died on the 6th day of April 1743, and lies buried under the cloister of Lincoln's Inn Chapel. MEM. PAT. OPT. MER. FIL. DIC." The son, by whom this character is drawn, is William Melmoth, Esq; the celebrated translator of Pliny and of Cicero's Letters; and author of those which pass under the name of *Sir Thomas Fitzosborne*.

MELOCHIA, JEWS MALLOW, in botany: A genus of the pentandria order, belonging to the monodelphia class of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The capsule is quinquelocular and monospermous. There are several species; but the only remarkable one is the olitorius, or common Jews-mallow, which is a native of the warm parts of Asia and America.—It is an annual plant, which rises about two feet high, dividing into several branches, garnished with leaves of different sizes and forms; some are spear-shaped, others are oval, and some almost heart-shaped: they are of a deep green, and slightly indented on their edges, having near their base two brisly reflexed segments. They have very long slender footstalks, especially those which grow on the lower part of the branches. The flower sits close on the opposite side of the branches to the leaves, coming out singly; they are composed of five small yellow petals, and a great number of stamina surrounding the oblong germen, which is situated in the centre of the flower, and afterwards turns to a rough swelling capsule two inches long, ending in a point, and

and having four cells filled with angular greenish seeds. This species is cultivated about the city of Aleppo in Syria, and in the East Indies, as a pot-herb; the Jews boiling the leaves, and eating them with their meat. It is supposed by Rauwolf to be the *olus Judaicum* of Avicenna, and the *corchorum* of Pliny.

MELODUNUM, (anc. geog.), a town of the Cenones in Gallia Celtica above Lutesia, now *Melun*, in the isle of France, on the Seine.

MELODY, in music, a succession of sounds ranged in such a manner, according to the laws of rhythmus and modulation, that it may form a sentiment agreeable to the ear. Vocal melody is called *singing*, and that which is performed upon instruments may be termed *symphonic melody*.

The idea of rhythmus necessarily enters into that of melody. An air is not an air but in proportion as the laws of measure and quantity are observed. The same succession of sounds is susceptible of as many different characters, as many different kinds of melody, as the various ways by which its emphatic notes and the quantities of those which intervene, may be diversified; and the change of duration of the notes alone, may disguise that very succession in such a manner that it cannot be known. Thus, melody in itself is nothing; it is the rhythmus or measure which determines it, and there can be no air without time. If then we abstract measure from both, we cannot compare melody with harmony; for to the former it is essential, but not at all to the latter.

Melody, according to the manner in which it is considered, has a relation to two different principles. When regarded only as agreeable to the proportions of sound and the rules of modulation, it has its principle in harmony; since it is a harmonical analysis, which exhibits the different gradations of the scale, the chords peculiar to each mode, and the laws of modulation, which are the sole elements that compose an air. According to this principle, the whole power of melody is limited to that of pleasing the ear by agreeable sounds, as the eye may be pleased with an agreeable assemblage of suitable colours. But when considered as an imitative art, by which we may affect the mind with various images, excite different emotions in the heart, inflame or soothe the passions; by which, in a word, we produce different effects upon our moral faculties, which are not to be effectuated by the influence of external sense alone, we must explore another principle for melody: for in our whole internal frame there appears to be no power upon which either harmony alone, or its necessary results, can seize, to affect us in such a manner.

What then is the second principle? It is as much founded on nature as the first; but, in order to discover its foundation in nature, it will require a more accurate though simpler observation, and a more exquisite degree of sensibility in the observer. This principle is the same which varies the tone of the voice, when we speak according as we are interested in what we say, and according to the different emotions which we feel in expressing it. It is the accent of languages which determines the melody of every nation; it is the accent which determines as to employ the emphasis of speaking while we sing, and to speak with more or less energy according as the language which we use is more or less accented. That language whose accents are the most sensible ought to produce a more passionate and more lively melody; that which has little accentuation, or none at all, can only produce a cold and languid melody, without character and without expression. These are the true principles: in proportion as we depart from them, when we speak of the power of music upon the human heart, we shall become unintelligible to ourselves and others, our words will be without meaning.

If music does not impress the soul with images but by melody, if from thence it obtains its whole power, it must follow, that all musical sounds which are not pleasing by themselves alone, however agreeable to harmony they may be, is not an imitative music; and being incapable, even with its most beautiful chords, either to present the images of things, or to excite the finer feelings, very soon cloys the ear, and leaves always the heart in cold indifference. It follows likewise, that notwithstanding the parts which harmony has introduced, and which the present taste of music so wantonly abuses, wherever two different melodies are heard at the same time, they counteract each other, and destroy the effects of both, however beautiful each may be when performed alone: from whence it may be judged with what degree of taste the French composers have introduced in their operas the miserable practice of accompanying one air with another, as well in singing, which is the native expression of pathos and sentiment, as in instrumental performances; which is the same thing as if whimsical orators should take it in their heads to recite two orations at the same time, that the elegance of each might derive more force from the other.

So much for Rousseau. The translator, however, has reason to fear, that the causes by which national melody is diversified and characterised, are more profound and permanent than the mere accentuation of language. This indeed may have great influence in determining the nature of the rhythmus, and the place of emphatic notes; but very little in regulating the nature of the emphasis and expression themselves. If Rousseau's principle be true in its full extent, he must of necessity acknowledge, than an air which was never set or intended for words, however melodious, cannot be imitative: we must likewise confess that what is imitative in one nation cannot be such in another: nor can it be denied upon his hypothesis, that the recitative, which is formed upon the mode of speaking, is the most forcible of all melodies; which is absurd. His other observations are at once judicious and profound. Though it is impossible to exhibit the beauty and variety of harmony by playing the same melody at the same time upon different keys, admitting those keys to form among themselves a perfect chord, which will of consequence preserve all the subsequent notes in the same intervals; yet this perfect harmony would by no means be uniformly pleasing to the ear. We must therefore of necessity introduce less perfect chords to vary and increase the pleasure, and these chords in any complex system of music must of necessity produce dissonances. It then becomes the business of the composer to be careful that these discords may arise as naturally from, and return as naturally to, perfect harmony,

many as possible. All these causes must inevitably vary the melody of the different parts; but still, amidst all these difficulties, the artist ought to be zealous in preserving the melody of each as homogeneous with the others as possible, that the result of the whole may be in some measure uniform. Otherwise, by counteracting each other, the parts will reciprocally destroy the effects one of another.

MELOE, in zoology; a genus of insects of the order of coleoptera. The antennæ are jointed, the last joint being oval; the breast is roundish; the elytra are soft and flexible; and the head is inflected, and gibbous. The insects of this genus are divided into two families; one without wings, and having the elytra shorter than the abdomen; and the other winged, with elytra shorter than the body and wholly covering the wings.—The most remarkable species are,

1. The proscarabæus: the colour of which is black, but without brightness, though intermixed with a small degree of purple, especially towards the under part of the body. Its head, which is large, is dotted; as is the thorax, which is narrower, round, and without a margin. The elytra are as soft as leather, shagreened, and cover but part of the abdomen. They are, as it were, cut off obliquely, from the inner to the outer part, being shorter towards the future, longer on the sides. There are no wings under the elytra. The abdomen, is large, especially that of the female, in which it far exceeds the elytra.—This insect makes its abode on the side of wet roads and in woods. Its food are insects, violet leaves, and delicate herbs. There oozes from its body a fat unctuous matter of an agreeable smell. The males are less than the females,

2. The vesicatorius, or blistering meloe, is nine or ten lines in length, of a shining green colour mixed with azure. It multiplies greatly. They are sometimes seen flying in swarms. A nauseous smell, not unlike that of mice, bespeaks their approach; which scent leads to the discovery of them when they are sought for in order to make a provision. When dried, they are so light, that 50 scarce weigh one dram. They prey upon the leaves of trees and shrubs, and in preference take to those of the ash-tree. The odorous particles exhaled by these insects, are extremely corrosive. Great caution should be used in picking them up. People have been known to be seized with violent heat of urine, voiding of blood, for having gathered a quantity of them during the heat of the sun with their hands bare, or for having fallen asleep under trees where swarms of them had settled. The copulation of these insects is performed during the most intense heat of the day.

There are many other species, differing in size, figure, and colour. Nature has apparelled almost all of them in a splended manner. Green, azure, and gold render them dazzling to the eyes. They are most common in the southern parts of the continent. In this genus, as well as in some others, the females court and in the act take the place of the males. The females deposit their eggs in the ground, whence proceed larvæ, which pass through the state of chrysalids in order to attain to that of meloes.

Uses. Oil in which insects of the first species have been infused is said to be an excellent topical for wounds and the scorpion's sting. It enters also into the composition of salve for plague sores. The insects bruised and mixed with oil or honey, Linnæus says, are commended as a remedy in the rabies canina.

The *second* species is the cantharis of the shops; which when bruised, is universally used as a blistering plaster. The largest and most esteemed of this sort come from Italy. Cantharides are extremely acrimonious: applied to the skin, they first inflame, and afterwards excoriate the part, raising a more perfect blister than any of the vegetable acrids, and occasioning a more plentiful discharge of serum. All the blistering compositions have cantharides for their basis. The external application of cantharides is often followed by a strangury, accompanied with thirst and feverish heat: this inconvenience may be remedied by soft unctuous or mucilaginous liquors liberally drank.

Cantharides taken internally often occasion a discharge of blood by urine, with exquisite pain. If the dose is considerable, they seem to inflame and exulcerate the whole intestinal canal; the stools become mucous and purulent; the breath fetid and cadaverous; intense pains are felt in the lower belly; the patient faints, grows giddy, raving mad, and dies. All these terrible consequences have sometimes happened from a few grains. Herman relates, that he has known a quarter of a grain inflame the kidneys, and occasion bloody urine with violent pain. There are nevertheless cases in which this stimulating fly, given in larger doses, proves not only safe, but of singular efficacy for the cure of diseases that yield little to medicines of a milder class. In cold phlegmatic sluggish habits, where the viscera are overloaded, and the kidneys and ureters obstructed with thick viscid mucous matter, cantharides have excellent effects: here the abounding mucus defends the solids from the acrimony of the fly, till it is itself expelled; when the medicine ought to be discontinued. Groenvelt employed cantharides with great success in dropsies, obstinate suppressions of urine, and ulcerations of the bladder; giving very considerable doses made into boluses with camphor; and interposing large draughts of emulsions, milk, or other emollient liquids: by this means, the excessive irritation, which they would otherwise have occasioned, was in great measure prevented. The camphor did not perhaps contribute so much to this effect as is generally imagined, since it has no sensible quality that promises any considerable abatement of the acrimony of cantharides: nitre would answer all that the camphor is supposed to perform; this, with milk, or emollient mucilaginous liquors, drank in large quantity, are the best correctors. Cantharides, in very small doses, may be given with safety also in other cases. Dr Mead observes, that the obstinate gleetings which frequently remain after the cure of venereal maladies, and which rarely yield to balsamic medicines are effectually remedied by cantharides; and that no one remedy is more efficacious in leprous disorders; in which last, proper purgatives are to be occasionally taken during the use of the cantharides. The best and safest preparation of cantharides for these purposes, is a spirituous tincture; and indeed, in all cases the tincture is far preferable, for internal use, to the fly in substance.

The virtues of cantharides are extracted by rectified spirit

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spirit of wine, proof spirit, and water; but do not arise in distillation. The watery and spirituous extracts blister as freely as the fly in substance; whilst the fly remaining after the several menstrua have performed their office, is to the taste insipid, and does not in the least blister or inflame the skin.

*See Cucumis.

MELON, in botany, a species of CUCUMIS *, in the Linnæan system. The female flowers have no stamina or summits, but have a very large oval germen, situated below the flower, which turns to an oval fruit with several cells, filled with oval, acute-pointed, compressed seeds, inclosed in a soft pulp. There is a great variety of this fruit cultivated in different parts of the world, many of them of no value, size being regarded too much in the markets. The *Cantaleupe melon*, so called from a place in the neighbourhood of Rome, where this fruit has been long cultivated, and whither it was brought from Armenia, is in the greatest esteem among the curious in every part of Europe. Besides this, there are also the *romano*, the *succado*, the *Zatte*, the small *Portugal* or *dormer*, and the black *Galloway* melons, most of which are cultivated for an early crop.

The management and culture of melons in England are as follow; the seeds should be procured from good melons, of the soundest sort and highest flavour, produced, as some have advised, in a distant garden; for if sown on the place where it was raised and ripened, it is very apt to degenerate. This seed should be kept three years before it is sown but not more than six; and if it should be sown at two seasons, or if at three it will be still better: the first for the early crop, to be raised under frames, should be sown about the middle of February; the second, to be raised in the same manner, is to be sown about the middle of March; and those which are designed for hand or bell-glasses, or to be covered with oil-papers, should not be sown till about a week in April.

For those of the first season, the seeds may be sown on the upper side of a cucumber-bed, if there be any; or, a proper quantity of new loose dung must be provided, and thrown on a heap to ferment, and turned over, that it may acquire an equal heat; and the plants must be raised and managed like cucumbers, until they are planted where they are to remain. The beds or ridges, where the plants are to remain, should be placed in a warm situation, so that they may be defended from all cold and strong winds, and inclosed in a good reed fence. In preparing the earth for these plants, the Dutch and German gardeners form a mixture of a third part of hazel loam, a third part of the scouring of ditches and ponds, and the same quantity of very rotten dung; which they mix up at least one, and often two years, before they make use of it, frequently turning it over, so that the parts may be well incorporated; but the compost in which Mr Miller has found melon plants to succeed best in England is two thirds of fresh gentle loam, and one-third of rotten neat's dung; if these are mixed together one year before it is wanted, so as to have the benefit of a winter's frost and summer's heat, observing to turn it over often, and never suffering weeds to grow upon it, this will be found equal to any compost whatever. Before the plants appear, there should be a quantity of new dung thrown in a heap, allowing about 15 wheelbarrows full to each light; which must be turned over two or three times, and in a fortnight it will be fit for use; when the trench must be dug to receive the dung where the bed is designed to be made, which in a dry ground should not be less than a foot or foot and a half deep. The frames should then be placed over the bed to keep out the wet; but no earth should be laid upon it for three or four days, till it is found of a proper temperature of heat. When this is the case, the earth may be laid upon it, about two inches thick, except in the middle of each light, where the plants are to be placed, which must be raised into a hill 15 inches high or more, terminating in a flat cone: in two or three days after the earth is put on the bed, it will be of a proper temper to receive the plants; which should be carefully taken up with a trowel, so as to preserve all the fibres of their roots; or if the beds cannot be ready for them in time, soon after the third or rough leaf is put out, it will be a good method to put each plant into a small pot while they are young, and these may be plunged into the hot-bed where they were raised, or in a cucumber-bed, where there is room; and when the bed is ready, the plants may be turned out of the pots with the whole ball of earth to their roots: and this is the best method for the Cantaleupe melon. When the plants are placed on the top of the hills, they should be gently watered once or twice, till they have taken good root; and when they are well fixed in the new beds, a greater quantity of earth should be laid on the beds, pressed down as close as possible, and raised at least a foot and a half thick upon the dung all over the bed; observing also to raise the frames, that the glasses may not be too near the plants lest the sun should scorch them. When the plants have four leaves, the top of the plants should be pinched off with the finger and thumb, that they may put out lateral branches for producing the fruit; and when two or more of these lateral shoots are produced, they must also be pinched to force out more. The management of these beds is much the same as that of cucumbers, except that melons require more air and very little water. In five or six weeks the plants will spread over the bed, and reach to the frames, when the alleys between the beds should be dug out; or in case of one bed, a trench should be made on each side about four feet wide, as low as the bottom of the bed; and hot dung wheeled in for a lining, to the same height as the dung of the bed; this should be trodden down close, and covered with the same earth that was laid on the bed, to the thickness of a foot and a half or more, treading it down as close as possible. In this way the bed will be extended to the width of 12 feet, that the roots of the plants may spread quite through it; and the beds will also require a fresh warmth, which will be of great service in setting of the fruit. When the vines have extended so as to fill the frames, and want more room, the frames should be raised up with bricks about three inches high, to admit the shoots of the vines to run out under them. When the fruit appears, the vines should be carefully looked over three times a week; and one should be chosen upon each runner that is situated nearest the stem, having the largest foot-stalk, and appearing to be the strongest fruit; then pinch off all the other fruit which may appear upon the same runner, and pinch off the end of the runner at the third joint above the fruit; and if the runner is gently pinched at the next joint

Melon. joint above the fruit, it will ſtop the ſap and ſet the fruit. There is alſo another method practiſed by ſome gardeners to ſet this fruit, which is the taking off ſome of the male flowers, whoſe farina is juſt ripe and fit for the purpoſe, laying them over the female fruit, and gently ſtriking with the nails the male flowers, to ſhake the farina into the female flowers; whereby they are impregnated, and the fruit will ſoon after ſwell, and manifeſt viſible ſigns of being perfectly ſet; ſo that where the plants are under frames, and the wind excluded from them, which is wanted to convey the farina from the male to the female flowers, this practice may be very neceſſary. The glaſſes of the hot-bed ſhould alſo be raiſed high to admit a large ſhare of air to the plants, otherwiſe the fruit will not ſet; and if the ſeaſon ſhould prove very warm, the glaſſes may be frequently drawn off, eſpecially in an evening, to receive the dews, provided there is little wind ſtirring: but they ſhould not remain off the whole night, leſt the cold ſhould prove too great. When the plants have extended themſelves from under the frames, in cold weather their extremities ſhould be covered every night with mats, and the plants ſhould be watered once in a week in dry warm weather, in the alleys between the beds.

For thoſe melons that are raiſed under bell or hand-glaſſes, the plants ſhould be raiſed in the manner already directed, and about the latter end of April, in a forward ſeaſon, the beds may be made. For this purpoſe, a ſufficient qantity of hot-dung ſhould be provided allowing eight or nine good wheel-barrows of dung to each glaſs. For one bed extended in length, the trench ſhould be cut out three-one-half feet wide, and of ſuch a length, that the glaſſes may not be placed nearer than four feet to each other: in digging the trench, it ſhould be ſo ſituated, as to allow for the widening of the bed three or four feet on each ſide; the depth muſt depend on the nature of the ſoil; and when there is no danger of the beds being injured by the wet, the lower it is made the better. When the dung prepared as before is laid on the bed, there ſhould be a hill for each plant, one foot and a half high, and the other part need not be covered more than four inches thick; the glaſſes ſhould then be placed over the hills, and in two or three days after the beds are made they will be fit for receiving the plants, which ſhould be removed in the manner already directed. Theſe plants muſt be watered at firſt, to ſettle the earth to their roots, and ſhaded every day, till they have taken new root; and if the nights prove cold, it will be proper to cover the glaſſes with mats, in order to preſerve the warmth of the bed. If ſeveral beds are made, they ſhould be placed at eight feet diſtance from each other. When the plants have taken good root, their tops muſt be pinched off, and the pruning muſt be the ſame as for thoſe under frames. In the day-time, when the weather is warm, the glaſſes ſhould be raiſed on the oppoſite ſide to the wind, to admit freſh air to the plants; and when they reach the ſides of the glaſſes, in favourable weather the glaſſes muſt be ſet up on three bricks, that the vines may have room to run out under them; but when this is done, the beds ſhould be covered all over with earth to the depth of one foot and an half, and trod down as cloſe as poſſible; and in cold nights, the beds ſhould be covered with mats. And as the vines of the Cantaleupe melons cannot bear wet without injury, it will be neceſſary to arch the beds over with props to ſupport the mats, that they may be ready for covering at all times when they require it. If the weather ſhould prove cold, hot dung may be laid to theſe beds in the manner directed for thoſe under frames. Some have lately raiſed their melons with conſiderable ſucceſs under oiled paper; but great care muſt be taken not to keep theſe coverings too cloſe over them. And Miller adviſes to bring up the plants under hand or bell glaſſes, till they begin to extend themſelves under the glaſſes, and then, inſtead of the covering of mats, to put over them the paper done over with linſeed oil.

The farther management of melons, after their fruit is ſet, is to keep pulling off all the ſuperfluous fruit, and to pinch off all weak runners; and alſo to turn the fruit gently twice a-week, that each ſide may have equal benefit of the ſun and air. When the fruit is fully grown, care ſhould be taken to cut it at a proper time; for if it is left a few hours upon the vines, it will loſe much of its delicacy: therefore the vines ſhould be looked over at leaſt twice in a day: and if the fruit intended for the table is cut early in the morning, before the ſun has warmed it, it will be much better flavoured; but if it ſhould be neceſſary to cut any afterwards, it ſhould be put into cold ſpring water or ice to cool it, before it is brought to table; and that cut in the morning ſhould be kept in the cooleſt place till it is uſed. The ſigns of this fruit's maturity is, its beginning to crack near the foot-ſtalk, and its beginning to ſmell, which never fail: but the Cantaleupe melons ſeldom change their colour till they are too ripe.

Mr Reynolds has communicated to the Society of Arts the following method of raiſing melons without earth, dung, or water. About a month before the ſeeds are ſown, he prepares a bed of caſt-off tanner's bark, four feet deep, ſix feet wide, and twelve feet in length: this he covers with four lights, ſo as not to admit rain or water. March (he ſays) is a proper ſeaſon for this purpoſe. When the bed becomes warm, which generally happens in about 20 days, a few melon ſeeds are put into warm milk in an earthen veſſel, which is preſſed down into the bark-bed, where it remains 36 hours, in order to promote the vegetation of the ſeeds. Then, at equal diſtances, he directs to open four holes in the bed, each nine inches in diameter, and five inches deep; having in readineſs about a peck of pounded bark, like ſaw-duſt, ſome of it to be put at the bottom of the holes, to the thickneſs of three inches: on this bark ſome of the ſeeds are to be placed, and preſſed down with the fingers; then the ſeeds are to be covered with two inches more of the powdered bark, preſſing the whole down with the hand. When the plants are advanced to a proper ſize, the beſt are choſen and the others caſt away; thoſe that are reſerved are ordered to be properly pruned, and to have as much warm air as poſſible during the ſummer. In this way (he ſays) he has raiſed as good melons as can be deſired.

When a melon is perfectly fine, it is full without any vacuity: this is known by knocking upon it; and when cut, the fleſh muſt be dry, no water running out,

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out, only a litte dew, which is to be of a fine red colour. Large melons are not to be coveted, but firm and well-flavoured ones. Our gardeners who raise melons for sale, sow the seeds of the larger rather than the good kinds, and they increase the size of these by much watering the roots; but this spoils the taste. Some of the French raise at this time particularly fine melons, by a method kept as a secret, but which we find, on a strict enquiry, is no other than the ingenious Mr Quintiny's of that nation, published near 80 years ago in the Philosophical Transactions.

The melons particularly proper to be treated in this manner, are those which have a thin and somewhat embroidered skin, not divided by ribs, and have a red pulp, dry and melting on the tongue, not mealy, and of a high flavour. These are what succeed in the following method, and are greatly improved in size and flavour by it.

When the seeds of this melon are placed in the ground, the first thing that appears is a pair of seminal leaves, or *ears*, as the gardeners call them. Between these two leaves there shoots, some days after, a leaf called the *first leaf* or *knot;* and out of the same place, after some days more, there shoots another leaf, called the *second knot*. Out of the midst of this stalk of the second knot, there shoots a third knot; this third knot must be cut off at its insertion, without hurting the branch of the second knot from whence it grows. Out of this place there will grow, after this cutting, a branch, which will be what the gardeners call the *first arm;* and this arm will, in the same manner as the first plant, shoot out, first one, then a second, and then a third knot; this third knot must be cut again as before, and thus the third knots are all along to be cut off, and arms or branches will grow up in the places of them all the way in the same manner as the first; and it is at those arms that the melons will be produced, and they will be always good, if the foot or root be well nourished in good earth, and cherished by a good hot-bed and the sun. The foot of the melon must never be suffered to pass into the dung, and the earth must not be watered but moderately, when it is seen to grow too dry; but in this case, it must be moderately moistened in time, lest the shoot suffer by it. Twice or thrice a-week is often enough to water in the driest weather, and this must always be done about sunset; and when the heat of the sun is too violent, the melons must be covered with straw mats from 11 in the morning to about two in the afternoon. When it rains much, the melons must also be covered, lest it hurt them by too much moisture. (Philosoph. Transf. n° 45.)—If the root produce too many branches, the weakest are to be cut off, and only three or four left; and those which are left are to be such as have their knots closest to one another. When the plants are removed from the seed-bed to the places where they are to stand, if they are very strong, they should be planted single; but if otherwise, two are to be set in each hole.

When they are planted single, the two branches, which always grow on each side from the base of the seed-leaves, are to be left on; but when two plants are set together, these branches are to be cut off, otherwise all the branches will be too numerous, and they will entangle and spoil one another.

When the melons are knit, two of them only are to be left upon each foot, choosing those which are best placed, and next to the first and principal stalk, that is, to the heart of the foot. None but fair fruits are to be left, and such as have a thick and short tail; and the foot of the melon must be short, well trussed, and not far distant from the ground. Melons of a long stem, and having the stalk of the leaf too long and slender, are never vigorous. All the superfluous branches must be cut off from time to time, as they shoot out. There sometimes shoots out a branch more than is here mentioned, between the two seed-leaves or ears. If this is strong and vigorous, it is to be kept on, but if weakly, it is best to take it off, for it will never bear good fruit.

Water-Melon. See ANGURIA.

MELOS, (anc. geog.), an island between Crete and Peloponnesus, about 24 miles from Scyllæum. It is about 60 miles in circumference, and of an oblong figure. It enjoyed its independence for above 700 years before the time of the Peloponnesian war. This island was originally peopled by a Lacedæmonian colony, 1116 years before the Christian era. For this reason the inhabitants refused to join the rest of the islands and the Athenians against the Peloponnesians. This refusal was severely punished. The Athenians took Melos, and put to the sword all such as were able to bear arms. The women and children were made slaves, and the island left desolate. An Athenian colony repeopled it, till Lysander reconquered it and re-established the original inhabitants in their possessions.

MELOTHRIA, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. The calyx is quinquefid; the corolla campanulated and monopetalous; the berry trilocular and monospermous. There is only one species, viz. the pendula, a native of Carolina, Virginia, and also many of the American islands. The plants strike out roots at every joint, which fasten themselves into the ground, by which means their stalks extend to a great distance each way. The flowers are very small, in shape like those of the melon, of a pale sulphur colour. The fruit in the West Indies grows to the size of a pea, is of an oval figure, and changes to black when ripe: these are by the inhabitants sometimes pickled when they are green. In Britain the fruit are much smaller, and are so hidden by the leaves that it is difficult to find them. The plants are too tender to be reared in that country without artificial heat.

MELPOMENE (fab. hist.), one of the muses, daughter of Jupiter and Mnemosyne. She presided over tragedy. Horace has addressed the finest of his odes to her, as to the patroness of lyric poetry. She was generally represented as a young woman with a serious countenance. Her garments were splendid; she wore a buskin, and held a dagger in one hand and in the other a sceptre and crown.

MELROSE, a town of Scotland, in the county of Selkirk, and on the confines of Tweedsdale,

ſeated on the ſouth ſide of the river Tweed; with an ancient abbey now in ruins. W. Long. 2. 32. N. Lat. 55. 32.

This abbey was founded by king David I. in 1136. He peopled it with Ciſtertians brought from Rivale abbey in Yorkſhire, and dedicated it to the Virgin Mary. At the reformation James Douglas was appointed commendator, who took down much of the building, in order to furniſh materials for a large houſe to himſelf, which ſtill remains, and is dated 1590. Nothing is left of the abbey excepting a part of the cloiſter walls elegantly carved; but the ruins of the church are of moſt uncommon beauty. Part is at preſent uſed for divine ſervice, the reſt uncovered; but every part does great honour to the atchitect.—Alexander II. was buried beneath the great altar, and it is alſo the place of interment of the Douglaſes and other potent families.—Its ſituation is extremely pleaſant.

MELT OF FISHES. In the melt of a living cod there are ſuch numbers of thoſe animalcules ſaid to be found in the ſemen of all male animals, that in a drop of its juice, no larger than a grain of ſand, there are contained more than 10,000 of them; and conſidering how many ſuch quantities there are in the whole melt of one ſuch fiſh, it is not incredible, that there are more animals in one melt of it than there are living men at one time upon the face of the earth. However ſtrange and romantic ſuch a conjecture muſt appear, a ſerious conſideration and calculation will make it appear very plain. An hundred ſuch grains of ſand as thoſe juſt mentioned will make about an inch in length; therefore in a cubic inch there will be a million of ſuch ſands; and if there be 10,000 animals in each of thoſe quantities, there muſt be in the whole 150,000 millions, which is a number vaſtly exceeding that of mankind, even ſuppoſing the whole as populous as Holland.

MELTING CONE, in eſſaying, an hollow cone of braſs or caſt iron into which melted metalline ſubſtances are thrown, in order to free them from their ſcoriæ. When a ſmall quantity of matter is melted it will be ſufficient to rub the inſide of the cone with greaſe; but when the quantity is very large, eſpecially if it contains any thing ſulphureous, this caution of tallowing the moulds is not ſufficient. In this caſe the eſſayer has recourſe to a lute reduced to thin pap with water, which effectually prevents any injury to the cone.

MELTON-MOUBRAY, a town of Leiceſterſhire, 108 miles from London. It is a large built place, in a fertile ſoil; with a market on Tueſday, the moſt conſiderable for cattle of any in this part of the iſland. It is almoſt encompaſſed with a little river called the *Eye*, over which it has two fine bridges; and has a large handſome church, with a free-ſchool. Here are frequent horſe-races, and three fairs in the year,

MELVIL (Sir James), deſcended from an honourable Scots family, being the third ſon of the laird of Kaeth, was born about the middle of the 16th century. He went to France very young, in the capacity of page to Queen Mary, then married to the dauphin; and on the death of her huſband, followed her to Scotland, where he was made gentleman of her chamber, and admitted a privy-counſellor. She employed him in her moſt important concerns, till her unhappy confinement in Lochleven, all which he diſcharged with the utmoſt fidelity; and, from his own accounts, there is reaſon to conclude, that, had ſhe taken his advice, ſhe might have avoided many of her misfortunes. When ſhe was priſoner in England, ſhe recommended him ſtrongly to her ſon James; with whom he continued in favour and employment until the death of Queen Elizabath: James would then have taken him to England; but Melvil, now grown old, was deſirous of retiring from buſineſs, and in his retirement he drew up the memoirs of his paſt life for the uſe of his ſon. Theſe Memors were accidentally found in Edinburgh caſtle in the year 1660, though nobody knew how they came to be depoſited there were publiſhed in folio in 1683.

MEMBERS, in anatomy, the exterior parts, ariſing from the trunk or body of an animal, like the boughs from the trunk of a tree.

MEMBER, in architecture, denotes any part of a building; as a frieze, cornice, or the like,

MEMBER, is ſometimes alſo uſed for mouldings.

MEMBER, in grammar, is applied to the parts of a period or ſentence.

MEMBER, is alſo uſed to denote ſome particular order or rank in a ſtate or goverment; thus we ſay "member of a corporation, member of parliament, member of the council," &c.

MEMBRANE, MEMBRANA, in anatomy, a ſimilar part of animal body; being a thin, white, flexible, expanded ſkin formed of ſeveral ſorts of fibres interwoven together, and ſerving to cover or wrap up certain parts of the body. See anatomy *paſſim*.

MEMEL, or MEMMEL; a town of Pruſſia, ſituated on the northern extremety of the Curiſche Haf, an inlet of the ſea about 70 miles in length, which is here joined to the Baltic by a narrow ſtrait.—It is an ill-built town, with narrow dirty ſtreets; but remarkable for its extenſive commerce, being provided with the fineſt harbour in the Baltic. In 1784, 996 ſhips, amongſt which were 500 Engliſh, arrived here. The imports chiefly are, ſalt, iron, and ſalted herrings; the exports, which greatly exceed the imports, are amber, corn, hemp, flax, and particularly timber. An Engliſh conſul reſides here. The trade is daily increaſing, on account of the high duties which the court of Ruſſia has laid on the imports of Riga.

MEMNON (fab. hiſt.), a king of Ethiopia, ſon of Tithonus and Aurora. He came with a body of 10,000 men to aſſiſt his uncle Priam, during the Trojan war. He behaved with great courage, and killed Antillochus, Neſtor's ſon. The aged father challenged the Ethiopian monarch; but Memnon refuſed it on account of the venerable age of Neſtor, and accepted that of Achilles. He was killed in the combat, in the ſight of the Grecian and Trojan armies. Aurora prayed Jupiter to grant her ſon ſuch honors as might diſtinguiſh him from other mortals. The god conſented; and immediately a numerous flight of birds iſſued from the burning pile on which the body was laid and dividing themſelves into two ſeparate bodies fought with ſuch fury that above half of them fell down in the fire as victims to appeaſe the means of Memnon.

Theſe

Memnon | Memory.

These birds were called *Memnonides*; and it has been observed by some of the ancients, that they never failed to return yearly to the tomb of Memnon in Troas, and repeat the same bloody engagement in honour of the hero from whom they received their name. The Ethiopians or Egyptians, over whom Memnon reigned, erected a celebrated statue to the honour of their monarch. This statue had the wonderful property of uttering a melodious sound every day at sunrising like that which was heard at the breaking of the string of a harp when it is wound up. This was effected by the rays of the sun when they fell upon it. At the setting of the sun, and in the night, the sound was lugubrious. This is supported by the testimony of the geographer Strabo, who confesses himself ignorant whether it proceeded from the basis of the statue, or the people that were then around it. This celebrated statue was dismantled by order of Cambyses when he conquered Egypt; and its ruins still astonish modern travellers by their grandeur and beauty.

Memnon of Rhodes, one of the generals of Darius king of Persia, advised that prince to lay waste the country, in order to deprive Alexander the Great's army of support, and afterwards to attack Macedon; but this counsel was disapproved by Darius's other generals. Memnon behaved at the passage of the Granicus like an experienced general. He afterwards defended the city of Miletum with great courage; seized the islands of Chio and Lesbos; spread terror throughout all Greece; and would have put a stop to the conquests of Alexander, if he had not been prevented by death. Barsina, Memnon's widow, was taken prisoner with Darius's wife, and Alexander had a son by her named *Hercules*.

MEMOIRS, in matters of literature, a species of history, written by persons who had some share in the transactions they relate; answering to what the Romans called *Commentarii*.—The journals of the proceedings of a literary society, or a collection of matters transacted therein, are likewise called *Memoirs*.

MEMORY, a faculty of the mind, which presents to us ideas or notions of what is past, accompanied with a persuasion that the things themselves were formerly real and present. What we distinctly remember to have perceived, we as firmly believe to have happened, as what is now present to our senses.

The opinions of philosophers concerning the means by which the mind retains the ideas of past objects, and how those ideas carry with them evidence of their objects having been actually perceived, shall be laid before our readers in another place: (see METAPHYSICS Part I. chap. ii.) At present we shall throw together some observations on the Memory, which, being of a practical rather than of a speculative nature, cannot be admitted into the article where the nature of the faculty itself is discussed,

"When we remember with little or no effort, it is called *remembrance* simply, or *memory*, and sometimes *passive memory* *. When we endeavour to remember what does not immediately and (as it were) of itself occur, it is called *active memory*, or *recollection*. A ready recollection of our knowledge, at the moment when we have occasion for it, is a talent of the greatest importance. The man possessed of it seldom fails to distinguish himself in whatever sort of business he may be engaged." It is indeed evident, that when the power of retention is weak, all attempts at eminence of knowledge must be vain; for "memory is the primary and fundamental power †, without which there could be no other intellectual operation. Judgment and ratiocination suppose something already known, and draw their decisions only from experience. Imagination selects ideas from the treasures of remembrance, and produces novelty only by varied combinatios. We do not even form conjectures of distant, or anticipations of future, events, but by concluding what is possible from what is past."

* Beattie's Elements of Moral Science.

Memory.

† Idler.

Of a faculty so important, many rules have been given for the regulation and improvement; of which the first is, that he who wishes to have a clear and distinct remembrance, should be temperate with respect to eating, drinking, and sleep. The memory depends very much upon the state of the brain; and therefore whatever is hurtful the latter, must be prejudicial to the former. Too much sleep clouds the brain, and too little overheats it; therefore either of these extremes must of course hurt the memory, and ought carefully to be avoided. Intemperance of all kinds, and excess of passion, have the same ill effects; so that we rarely meet with an intemperate person whose memory is at once clear and tenacious,

"The liveliest remembrance is not so vivid as the sensation that produced it ‡; and ideas of memory do often, but not always, decay more and more, as the original sensation becomes more and more remote in time. Those sensations and those thoughts have a chance to be long remembered which are lively at first; and those are likely to be most lively which are most attended to, or which are accompanied with pleasure or pain, with wonder, surprise, curiosity, merriment, and other lively passions. The art of memory, therefore, is little more than the art of attention. What we wish to remember we should attend to, so as to understand it perfectly, fixing our view particularly upon its importance or singular nature, that it may raise within us some of the passions abovementioned. We should also disengage our minds from all other things, that we may attend more effectually to the object which we wish to remember. No man will read with much advantage who is not able at pleasure to evacuate his mind, or who brings not to his author an intellect defecated and pure, neither turbid with care, nor agitated with pleasure. If the repositories of thought are already full, what can they receive? If the mind is employed on the past or the future, the book will be held before the eyes in vain.

‡ Beatie's Elements, &c. and Idler.

"It is the practice of many readers, to note in the margin of their books the most important passages *, the strongest argumeuts, or the brightest sentiments. Thus they load their minds with superfluous attention, repress the vehemence of curiosity by useless deliberation, and by frequent interruption break the current of narration or the chain of reason, and at last close the volume and forget the passages and the marks together. Others are firmly persuaded, that nothing is certainly remembered but what is transcribed; and they, therefore, pass weeks and months in transferring large quotations to a common place-book. Yet, why any part of a book which can be consulted

* Elements of Moral Science.

Memory. consulted at pleasure should be copied, we are not able to discover. The hand has no closer correspondence with the memory than the eye. The act of writing itself distracts the thoughts; and what is read twice, is commonly better remembered than what is transcribed. This method, therefore, consumes time, without assisting the memory. But to write an abridgement of a good book may sometimes be a very profitable exercise. In general, when we would preserve the doctrines, sentiments, or facts, that occur in reading, it will be prudent to lay the book aside, and put them in writing in our own words. This practice will give accuracy to our knowledge, accustom us to recollection, improve us in the use of language, and enable us so thoroughly to comprehend the thoughts of other men, as to make them in some measure our own."

* Idler. "Our thoughts have for the most part a connection *; so that the thought which is just now in the mind, depends partly upon that which went before, and partly serves to introduce that which follows.—Hence we remember best those things of which the parts are methodically disposed and mutually connected. A regular discourse makes a more lasting impression upon the hearer than a parcel of detached sentences, and gives to his rational powers a more salutary exercise; and this may show us the propriety of conducting our studies, and all our affairs, according to a regular plan or method. When this is not done, our thoughts and our business, especially if in any degree complex, soon run into confusion."

As the mind is not at all times equally disposed for the exercise of this faculty, such seasons should be made choice of as are most proper for it. The mind is seldom fit for attention presently after meals; and to call off the spirits at such times from their proper employment in digestion, is apt to cloud the brain, and prejudice the health. Both the mind and body should be easy and undisturbed when we engage in this exercise, and therefore retirement is most fit for it: and the evening, just before we go to rest, is generally recommended as a very convenient season, both for the stillness of the night, and because the impressions will then have a longer time to settle before they come to be disturbed by the accession of others proceeding from external objects; and to call over in the morning what has been committed to the memory over-night, must, for the same reason, be very serviceable. For, to review those ideas while they continue fresh upon the mind, and unmixed with any others, must necessarily imprint them more deeply.

Some ancient writers speak of an artificial memory, and lay down rules for attaining it. Simonides the poet is said first to have discovered this, or at least to have given the occasion for it. The story they tell of him is this: Being once at a feast, he recited a poem which he had made in honour of the person who gave the entertainment. But having (as is usual in poetry) made a large digression in praise of Castor and Pollux; when he had repeated the whole poem, his patron would give him but half the sum he had promised, telling him he must get the other part from those deities who had an equal share in the honour of his performance. Immediately after, Simonides was told that two young men were without, and must needs speak with him. He had scarce got out of the house, when the room where the company was fell down, killed all the persons in it, and so mashed the bodies, that, when the rubbish was thrown off, they could not be known one from another: upon which Simonides recollecting the place where every one had sat, by that means distinguished them. Hence it came to be observed, that to fix a number of places in the mind in a certain order, was a help to the memory: As we find by experience, that, upon returning to places once familiar to us, we not only remember them, but likewise many things we both said and did in them. This action therefore of Simonides was afterwards improved into an art; and the nature of it is this: They bid you form in your mind the idea of some large place or building, which you may divide into a great number of distinct parts, ranged and disposed in a certain order. These you are frequently to revolve in your thoughts, till you are able to run them over one after another without hesitation, beginning at any part. Then you are to impress upon your mind as many images of living creatures, or any other sensible objects which are most likely to affect you, and be soonest revived in your memory. These, like characters in short-hand, or hieroglyphics, must stand to denote an equal number of other words, which cannot so easily be remembered. When therefore you have a number of things to commit to memory in a certain order, all that you have to do is, to place these images regularly in the several parts of your building. And thus they tell you, that, by going over several parts of the building, the images placed in them will be revived in the mind; which of course will give you the things or words themselves in the order you desire to remember them. The advantage of the images seems to be this; that, as they are more like to affect the imagination than the words for which they stand, they will for that reason be more easily remembered. Thus, for instance, if the image of a *lion* be made to signify *strength*, and this word *strength* be one of those I am to remember, and is placed in the porch; when, in going over the several parts of the building, I come to the porch, I shall sooner be reminded of that image than of the word *strength*. Of this artificial memory, both Cicero and Quintilian speak; but we know not of any modern orator that has ever made use of it. It seems indeed to have been a laborious way of improving the memory, if it serves that end at all, and fitter for assisting us to remember any number of unconnected words than a continual discourse, unless so far as the remembrance of one word may enable us to recollect more. It is, however, in allusion to it, that we still call the parts of a discourse *places* or *topics*, and say, *in the first place*, *in the second place*, &c.

But, doubtless, the most effectual way to gain a good memory, is by constant and moderate exercise of it; for the memory, like other habits, is strengthened and improved by daily use. It is indeed hardly credible, to what a degree both active and passive remembrance may be improved by long practice. *Scaliger* reports of himself, that in his youth he could re-

Memory, Memphis.

peat above 100 verses, having once read them; and *Berthicus* declares, that he wrote his *Comment upon Claudian* without consulting the text. To hope, however, for such degrees of memory as these, would be equally vain as to hope for the strength of *Hercules*, or the swiftness of *Achilles*. "But there are clergymen who can get a sermon by heart § in two hours, though their memory, when they began to exercise it, was rather weak than strong: And pleaders, with other orators who speak in public and *extempore*, often discover, in calling instantly to mind all the knowledge necessary on the present occasion, and every thing of importance that may have been advanced in the course of a long debate, such powers of retention and recollection as, to the man who has never been obliged to exert himself in the same manner, are altogether astonishing. As habits, in order to be strong, must be formed in early life, the memories of children should therefore be constantly exercised; but to oblige them to commit to memory what they do not understand, perverts their faculties, and gives them a dislike to learning." In a word, those who have most occasion for memory, as orators and public speakers, should not suffer it to lie idle, but constantly employ it in treasuring up and frequently reviving such things as may be of most importance to them; for by those means, it will be more at their command, and they may place greater confidence in it upon any emergency."

§ Idler.

"Men complain of nothing more frequently than of deficient memory ‡: and indeed every one finds, that after all his efforts many of the ideas which he desired to retain have slipped irretrievably away; that acquisitions of the mind are sometimes equally fugitive with the gifts of fortune; and that a short intermission of attention more certainly lessens knowledge than impairs an estate. To assist this weakness of our nature, many methods besides those which we have mentioned have been proposed; all of which may be justly suspected of being ineffectual: for no art of memory, however its effects may have been boasted or admired, has been ever adopted into general use; nor have those who possessed it appeared to excel others in readiness of recollection or multiplicity of attainments." The reader who is desirous to try the effect of those helps, may have recourse to a treatise entitled *A new Method of Artificial Memory*; but the true method of memory is attention and exercise.

‡ Elements of Moral Science.

MEMPHIS, an ancient city, and the royal residence of the kings in the Higher Egypt; distant from the Delta to the south 15 miles, according to Pliny. Called also *Moph* and *Noph*, in scripture.

Though this city is now so completely ruined, that authors greatly disagree concerning its situation; yet Strabo informs that in his time it was the most magnificent in Egypt, next to Alexandria. It was called the capital of the country; and there was an entire temple of Osiris, where the Apis or sacred ox was kept and worshipped. In the same place was an apartment of the mother of the ox; a very magnificent temple of Vulcan; a large Circus or space for fighting bulls; and a great Colossus in the middle of the city, which was thrown down. There was likewise a temple of Venus, and a Serapium in a very sandy place, where the wind heaps up hills of sand very dangerous to travellers; together with a number of Sphinxes, the heads of some of them only being visible, the others covered up to the middle of their body. The same author likewise informs us, that in the front of the city there were many lakes; and that it contained a number of palaces, at that time in ruins. These buildings, he said, formerly stood upon an eminence; they lay along the side of the hill, stretching down to the lakes and groves, 40 stadia from the city. There was likewise a mountain in the neighbourhood, on which were a great number of pyramids, with the sepulchres of the kings, among which were three remarkable, and two of them accounted wonders of the world. From this description, Mr Bruce concludes that the celebrated capital of Egypt stood in the place where the villages of Metrahenny are now situated; in opposition to Dr Shaw's opinion, who thinks it was situated at Geeza or Gisa.

Memphis.

M. Savary has also shown, that Gisa was not the situation of the ancient Memphis. This stood, he says, on the western bank of the Nile, on the spot where the village of Memph now stands, which still preserves the name. Large heaps of rubbish are still to be seen there; but the Arabs have transported to Cairo the columns and remarkable stones, which they have disposed, without taste and without order, in their mosques and public buildings. This city extended as far as Saccara; and was almost wholly encompassed by lakes, part of which are still subsisting. It was necessary to cross them to convey the dead to the sepulchre of their fathers. The tombs, hewn out of the rock, were closed up with stones of a proportionable size, and covered with sand. These bodies, embalmed with so much care, preserved with so much respect, are torn from the monuments they repose in, and sold without decency to strangers by the inhabitants of Saccara. This place is called *the plain of mummies*. There too we find *the well of the birds*, into which one descends by means of a rope. It leads to subterraneous galleries, filled with earthen vases, containing the sacred birds. They are rarely met with entire, because the Arabs break them in hopes of finding idols of gold. They do not conduct travellers into the places where they have found more precious articles. They even close them up carefully, reserving to themselves some secret passages by which they descend. In a journey into Egypt made by the duke de Chaulnes, he advanced very far into these winding labyrinths, sometimes crawling, and sometimes scrambling, on his knees. Informed by Mr Edward Wortley Montague, who has carefully visited Egypt, he arrived at one of those passages which had an opening shut up from without by branches of the date-tree interwoven, and covered with sand. He remarked there some hieroglyphics *in relievo*, executed in the highest perfection. But the Arabs resisted every offer he made them to permit him to take drawings of them, or to mold them, in order to preserve their form. The duke de Chaulnes is of opinion that these hieroglyphics, sculptured with so much art that the objects they represent may be discovered at the first sight, might possibly furnish the key of the others, whose contours are simply expressed, and form a sort of alphabet of this unintelligible language. Several pyramids are distin-

guishable

Menage || Menander.

guishable along the mountains which bound Saccara on the west, the greatest part of which appear as lofty as those of Gisa. See PYRAMIDS.

MENAGE (Fr.) denotes a collection of animals; whence we have derived the word *menagery*.

MENAGE (Giles), in Latin *Ægidius*, a celebrated French writer, born at Angers in 1613. He finished his studies in that city, was made advocate, and pleaded for some time at Angers, Paris, and Poictiers; but, becoming at length disgusted with the bar, turned ecclesiastic, and gave himself up entirely to the study of polite literature. He at length entered into the family of the cardinal de Retz; but disagreeing with some persons belonging to his Eminence, went to live in the cloister of Notre Dame, where he held an assembly of learned men every Wednesday. He read a great deal; had a prodigious memory; and was incessantly quoting in his conversation verses in Greek, Latin, Italian, French, &c. on which account he was often turned into ridicule by the wits, especially towards the end of his days. His great memory he retained even in his old age; and what is very rare, it returned to him after some interruption. The reputation of his works procured him a place in the academy *della Crusca* at Florence. He might have been a member of the French academy at its first institution, if it had not been for his *Requeste des Dictionnaires*: but when that was forgot, he was proposed in 1684 to fill up a vacant place in that academy, and was excluded only by the superior interest of his competitor Mr Bergent; for there was not one member of all those who gave their votes against them, but owned that he deserved the place. He would not suffer his friends to propose him again. He died at Paris in 1692, aged 79. He wrote a great number of books in prose and verse; the principal of which are, 1. Miscellaneous works. 2. The Origin of the French Language. 3. The Origin of the Italian Tongue; the best edition of which is that of Geneva, in 1685, folio. 4. An edition of Malherbes' Poems, with Notes. 5. An edition of Diogenes Laertius, with Observations. 6. Remarks on the French Tongue. 7. Greek, Latin, Italian, and French poems.

MENANDER, an ancient Greek poet, was born at Athens in the same year with Epicurus, which was the third of the 109th Olympiad. His happiness in introducing the new comedy, and refining an art which had been so gross and licentious in former times, quickly spread his name over the world. Pliny informs us, that the kings of Egypt and Macedon gave a noble testimony of his merit, by sending ambassadors to invite him to their courts, and even fleets to bring him over; but that Menander was so much of a philosopher, as to prefer the free enjoyment of his studies to the promised favours of the great. Of his works, which amounted to above 100 comedies, we have had a double loss, the originals being not only vanished, but the greatest part of them, when copied by Terence, having unfortunately perished by shipwreck before they saw Rome. Yet the four plays which Terence borrowed from him before that accident happened, are still preserved in the Roman habit; and it is chiefly from Terence that most people form their judgment of Menander, the fragments that remain of him not being sufficient to enable them to do it. The ancients have said high things of Menander; and we find the old masters of rhetoric recommending his works as the true patterns of every beauty and every grace of public speaking. Quintilian declares, that a careful imitation of Menander only, will satisfy all the rules he has laid down in his Institutions. It is in Menander that he would have his orator search for a copiousness of invention, for a happy elegance of expression, and especially for that universal genius which is able to accommodate itself to persons, things, and affections.—But Julius Cesar has left the loftiest as well as the justest praise of Menander's works, when he calls Terence only a *Half-Menander*. For while the virtues of the Latin poet are so deservedly admired, it is impossible we should raise a higher notion of excellency than to conceive the great original still shining with half its lustre unreflected, and preserving an equal part of its graces, above the power of the best copier in the world. Menander died in the 3d year of the 122d Olympiad, as we are taught by the same old inscription from which we learn the time of his birth. His tomb, in Pausanias's age, was to be seen at Athens, in the way from the Piræus to the city, close by the honorary monument of Euripides. Quintilian, in his judgement, of Afranius the Roman comedian, who imitated him, censures Menander's morals as much as he commends his writings; and his character, according to Suidas, is, that he was a very "mad fellow after women." Phædrus has given him the gait and dress of a most affected fop:

> "Unguento delibutus, vestitu adfluens.
> "Veniebat gressu delicatulo & languido."
> *Lib.* v. fab. 2.

Menander, Menandrians.

MENANDRIANS, the most ancient branch of Gnostics; thus called from Menander their chief, said by some, without sufficient foundation, to have been a disciple of Simon Magus, and himself a reputed magician.

He taught, that no person could be saved, unless he were baptised in his name: and he conferred a peculiar sort of baptism, which would render those who received it immortal in the next world: exhibiting himself to the world, with the phrensy of a lunatic more than the founder of a sect, as a promised saviour. For it appears by the testimonies of Irenæus, Justin, and Tertullian, that he pretended to be one of the Æons sent from the pleroma, or ecclesiastical regions, to succour the souls that lay groaning under bodily oppression and servitude; and to maintain them against the violence and stratagems of the dæmons that hold the reins of empire in this sublunary world. As this doctrine was built upon the same foundation with that of Simon Magus, the ancient writers looked upon him as the instructor of *Menander*. See SIMONIANS

MENASSEH (Ben Israel), a celebrated rabbi, born in Portugal about the year 1604, was the son of Joseph Ben Israel, and followed his father into Holland. Here he was educated by rabbi Isaac Uziel, under whom he in a short time made such progress in the Hebrew tongue, that at 18 years of age he succeeded him in the synagogue of Amsterdam. In this post he continued several years, and married Rachel of the

Mencke, Mendelshon.

the family of the Abarbanels, whom the Jews imagine to be descended from king David. He afterwards went to his brother Ephraim, a rich merchant, who had settled at Basil; by whose advice he entered into trade. Some time after, the hopes of a more agreeable settlement induced him to come into England, under the protectorship of Cromwell; who gave him a very favourable reception, and one day entertained him at his table with several other learned divines. However, he soon after passed into Zealand; and died at Middleburg about the year 1657. The Jews at Amsterdam obtained his body, and interred it at their expence. He was of the sect of the Pharisees; had a lively wit, a solid judgment, great learning, and all the virtues that can adorn private life. He wrote many works in Hebrew, Latin, Spanish, and English. The principal of those published in Latin, are 1. His *Conciliator;* a learned and curious work, in which he reconciles those passages of Scripture which seem to contradict each other. 2. *De resurrectione mortuorum.* 3. *De termino vitæ.* 4. *Dissertatio de fragilitate humana, ex lapsu Adami, deque Divino in bono opere auxilio.* 5. *Spes Israel.* Dr Thomas Pococke has written his life in English.

MENCKE (Lewis Otto), in Latin *Menckenius*, a learned professor of morality at Leipsic, was born at Oldenburg in Westphalia in 1644. He studied in several universities of Germany; and became an able philosopher, civilian, and divine. He was made professor of morality at Leipsic in 1668; and enjoyed that post to his death. He was five times rector of the university of that city, and seven times dean of the faculty of philosophy. He published several works; but his most considerable, and what alone is sufficient to perpetuate his memory, is the *Acta Eruditorum* of Leipsic, of which he was the first author, and in which he was engaged till his death. The first volume was published at Leipsic, in 4to, in 1682.

MENCKE (John Burchard), son to the preceding. After his studies he travelled into England and Holland; and upon his return was appointed professor of history at Leipsic in 1699. He gained great reputation by his lectures as well as his writings. He died in 1732, aged 58. He wrote many pieces. His *De Charlataneria eruditorum declamationes duæ*, is an excellent satire, designed to expose the artifices used by false scholars to raise themselves a name. As he named and pointed at certain persons, it exasperated them, and they procured his book to be seized; but it spread, and editions of it were multiplied. He likewise published *Methodé pour etudier l'Histoire, avec un catalogue des principaux historiens*, &c. He made a great many additions to Mr Linglet's book, especially with regard to the German historians.

MENDELSHON (Moses), that is, *Moses the son of Mendel*, a Jew of Berlin, and one of the most celebrated writers in Germany, died there in the year 1785 at the age of 57. His first attempt as an author was in 1755, by a work intitled *Jerusalem;* in which, besides other bold and unjustifiable opinions, he maintains, that the Jews have a revealed law but not a revealed religion; that opinions are not subjects of revelation; and that the only religion of the Jewish nation is that of nature. He acquired great honour by his *Phedon*, or "Discourse on the Immateriality and Immortality of the Soul," translated into French 1773, 8vo; in which he unfolds this important truth, the great foundation of all morality, with the wisdom of an enlightened philosopher and the charms of an elegant writer. In consequence of this excellent work, he was styled the *Jewish Socrates* by some of the periodical writers; but he wanted the firmness and courage of the Grecian philosopher. His timidity, and even pusillanimity, defects too common in speculative men, prevented him from being of any essential service to his nation; of which he might have become the benefactor by being the reformer. The pliancy of his character, his soft, modest, and obliging disposition, gained him the esteem alike of the superstitious and of the incredulous After all, he could never procure admission to the Berlin society, or to the conversation of the king of Prussia. At his death he received from his nation those honours which are commonly paid to their first rabbins. Contrary to an imprudent custom prevalent among the Jews of burying their dead before sunset, his interment was delayed till 24 hours after he expired. Though Mendelshon was descended from a respectable family, he was very poor. In early life he entered into a counting-house of his own nation, wherein he greatly recommended himself by his capacity and integrity in business: But philosophy and literature soon became his principal occupation; and to the famous Lessing he was indebted for counsels which, without diverting his attention from those pursuits that were necessary to his subsistence, accelerated his progress in his literary career. Even after the death of his benefactor, Mendelshon retained for him the sincerest regard and the most lively gratitude. Notwithstanding the very strict regimen which he observed, he survived him only a few years; for his feeble frame and weak constitution were gradually and insensibly undermined by intense application to study.

Mendelshon, Mendez.

MENDEZ PINTO (Ferdinand), was born at Montemor-o-velho in Portugal, and was at first servant to a Portuguese gentleman. In expectation of making a fortune, he embarked for India in 1537. His vessel being taken by the Turks on his passage, he was carried to Mocka, and sold to a Greek renegado, and afterwards to a Jew, in whose possession he continued till he was redeemed by the governor of Ormus, a Portuguese fort. The governor procured him an opportunity of going out to India, agreeable to his first design. During a residence of twenty-one years in that country, he was witness to very important transactions, and experienced many singular adventures. He returned to Portugal in 1558, where he enjoyed the reward of his labours, after having been thirteen times a slave and sixteen times sold. A very curious account of his travels was written by himself, and published at Lisbon, A. D. 1614, in folio. This work was translated into French by Bernard Figuier, a Portuguese gentleman, and printed at Paris 1645, in 4to. It is written in a very interesting manner, and in a style more elegant than might have been expected from a man whose whole life was spent in the camp and in slavery. It elucidates a great variety of particulars relating to the geography, history, and manners of the inhabitants of China, Japan, Pegu, Siam, Achem, Java, &c. Many of his facts appeared fabulous, but their truth has been since ascertained.

Mendicants.

M. de Surgi compiled an interesting history from the most singular facts in Mendex Pinto's relation, which he published in the *Vicissitudes de la Fortune*. Paris 2 vols. 8vo.

MENDICANTS, or BEGGING FRIARS, several orders of religious in Popish countries, who having no settled revenues, are supported by the charitable contributions they receive from others.

This sort of society began in the 13th century; and the members of it, by the tenor of their institution, were to remain entirely destitute of all fixed revenues and possessions; though in process of time their number became a heavy tax upon the people. Innocent III. was the first of the popes who perceived the necessity of instituting such an order; and accordingly he gave such monastic societies, as made a profession of poverty, the most distinguishing marks of his protection and favour. They were also encouraged and patronized by the succeeding pontiffs, when experience had demonstrated their public and extensive usefulness. But when it became generally known, that they had such a peculiar place in the esteem and protection of the rulers of the church, their number grew to such an enormous and unwieldy multitude, and swarmed so prodigiously in all the European provinces, that they became a burden, not only to the people, but to the church itself. The great inconvenience that arose from the excessive multiplication of the mendicant orders was remedied by Gregory X. in a general council, which he assembled at Lyons in 1272. For here all the religious orders that had sprung up after the council held at Rome in 1215, under the potificate of Innocent III. were suppressed; and the extravagant multitude of mendicants, as Gregory called them, were reduced to a smaller number, and confined to the four following societies or denominations, viz. the DOMINICANS, the FRANCISCANS, the CARMELITES and the AUGUSTINS or hermits of St Augustin.

As the pontiffs allowed these four mendicant orders the liberty of travelling wherever they thought proper, of conversing with persons of every rank, of instructing the youth and multitude wherever they went; and as those monks exhibited, in their outward appearance and manner of life, more striking marks of gravity and holiness than were observable in the other monastic societies, they arose all at once to the very summit of fame, and were regarded with the utmost esteem and veneration through all the countries of Europe. The enthusiastic attachment to these sanctimonious beggars went so far, that, as we learn from the most authentic records, several cities were divided or cantoned out into four parts, with a view to these four orders; the first part being assigned to the Dominicans, the second to the Franciscans, the third to the Carmelites, and the fourth to the Augustinians. The people were unwilling to receive the sacraments from any other hands than those of the mendicants, to whose churches they crowded to perform their devotions, while living, and were extremely desirous to deposite there also their remains after death: nor did the influence and credit of the mendicants end here; for we find in the history of this and of the succeeding ages, that they were employed, not only in spiritual matters, but also in temporal and political affairs of the greatest consequence, in composing the differences of princes, concluding treaties of peace, concerting alliances, presiding in cabinet councils, governing courts, levying taxes, and other occupations, not only remote from, but absolutely inconsistent with, the monastic character and profession. However the power of the Dominicans and Franciscans greatly surpassed that of the other two orders: insomuch that these two orders were, before the reformation, what the Jesuits have been since that happy and glorious period, the very soul of the hierarchy, the engines of the state, the secret springs of all the motions of the one and the other and the authors and directors of every great and important event, both in the religious and political world. By very quick progression their pride and confidence arrived at such a pitch, that they had the presumption to declare publicly, that they had a divine impulse and commission to illustrate and maintain the religion of Jesus; they treated with the utmost insolence and contempt all the different orders of the priesthood; they affirmed without a blush, that the true method of obtaining salvation was revealed to them alone; proclaimed, with ostentation, the superior efficacy and virtue of their indulgencies; and vaunted beyond measure their interest at the court of heaven, and their familiar connections with the supreme Being, the Virgin Mary, and the saints in glory. By these impious wiles, they so deluded and captivated the miserable, and blinded the multitude, that they would not intrust any other but the mendicants with the care of their souls. They retained their credit and influence to such a degree, towards the close of the 14th century that great numbers of both sexes, some in health others in a state of infirmity, and others at the point of death, earnestly desired to be admitted into the Mendicant order, which they looked upon as a sure and infallible method of rendering heaven propitious. Many made it an essential part of their last wills, that their bodies after death should be wrapped in old ragged Domincan or Franciscan habits, and interred among the Mendicants. For such was the barbarous superstition and wretched ignorance of this age, that people universally believed they should readily obtain mercy from Christ, at the day of judgment, if they appeared before his tribunal associated with the Mendicant friars.

About this time, however, they fell under an universal odium; but being resolutely protected against all opposition, whether open or secret, by the popes, who regarded them as their best friends and most effectual supports, they suffered little or nothing from the efforts of their numerous adversaries. In the 15th century, besides their arrogance, which was excessive, a quarelsome and litigious spirit prevailed among them, and drew upon them justly the displeasure and indignation of many. By affording refuge at this time to the Beguins in their order, they became offensive to the bishops, and were hereby involved in difficulties and perplexities of various kinds. They lost their credit in the 16th century by their rustic impudence, their ridiculous superstitions, their ignorance, cruelty, and brutish manners. They discovered the most barbarous aversion to the arts and sciences and expressed a like abhorrence of certain eminent and learned men, who endeavoured to open the paths of science

ſcience to the purſuits of the ſtudious youth, recommended the culture of the mind, and attacked the barbariſm of the age in their writings and diſcourſe. Their general character, together with other circumſtances, concurred to render a reformation deſirable, and to accompliſh this happy event.

Among the number of Mendicants are alſo ranked the Capuchins, Recollects, Minims, and others, who are branches or derivations from the former.

Buchannan tells us, the Mendicants in Scotland, under an appearance of beggary, lived a very luxurious life whence one wittily called them, not *Mendicant*, but *Manducant* friars.

MENDOZA (Juan Gonzales de), an Auguſtan friar, of the province of Caſtile, was made ambaſſador from the king of Spain to the emperor of China. In 1593, he was made biſhop of Liperi in Italy. In 1607 he was made biſhop of Chiapa in New Spain, and the next year was removed to the ſee of Popaian in the Weſt Indies. He wrote a hiſtory of China in Spaniſh, which has been tranſlated into ſeveral languages.

MENE, a Chaldæan word, which ſignifies "he has numbered or counted;" being one of the three words that was written upon the wall by the hand that appeared to Belſhazzar, the laſt king of Babylon, the night that he was put to death. See BELSHAZZAR.

MENECRATES, a phyſician of Syracuſe, who flouriſhed about 360 B. C. is famous for his ſkill in his profeſſion, but much more for his vanity. He would always be followed by ſome of the patients he had cured, and with whom he previouſly ſtipulated and they ſhould follow him wherever he went. One appeared with the attributes of Hercules, another with thoſe of Apollo, and others again with thoſe of Mercury or Æſculapius; while he, clad in a purple robe, with a golden crown on his head, and a ſceptre in his hand, preſented himſelf, to the admiration of the public, under the name of *Jupiter*, and travelled through different countries eſcorted by theſe counterfeit deities. He once wrote the following letter to the king of Macedon: Menecrates-Jupiter to Philip, greeting. Thou reigneſt in Macedonia, and I in medicine; thou giveſt death to thoſe who are in good health, I reſtore life to the ſick; thy guard is compoſed of Macedonians; the gods themſelves conſtitute mine." Philip anſwered him in a word, that he wiſhed him reſtored to reaſon. Learning ſome time after that he was in Macedon, Philip ſent for him, and invited him to an entertainment. Menecrates and his companions were placed on rich and lofty couches; before which was an altar, covered with the firſt fruits of the harveſt; and whilſt an excellent repaſt was ſerved up to the other gueſts, perfumes and libations only were offered to theſe new gods, who, unable to endure the affront, haſtily left the palace, in which they never more made their appearance.

MENEDEMUS, a Greek philoſopher, born at Erythreum, was the ſon of Caliſthenes, and one of Phedo's followers. He was in greateſt eſteem, and, enjoyed ſeveral important poſts, in his own country. He ſeveral times defended Erythreum with great bravery, and died of grief when Antigonus became maſter of it. A perſon one day ſaying to him, "It is a great happineſs to have what we deſire," he replied, "It is a much greater to deſire nothing but what we have." He flouriſhed about 300 B. C.

MENELAUS, the ſon of Atreus, and the brother of Agamemnon, reigned at Sparta, when Paris deprived him of his wife Helen. This rape occaſioned the famous war of Troy. See HELEN.

MENELAUS, a mathematician in the reign of the emperor Trajan, wrote three books on the *Sphere*, which have been publiſhed by father Marſenne.

MENES, born at This, a town of Thebais in Upper Egypt, was the founder of the Egyptian empire. He had three ſons, viz. Athotis, who ruled after him at This and Thebes; Curudes, who in Lower Egypt founded the kingdom of Heliopoli, which afterward was the kingdom of Dioſpoli; and Necherophes, who reigned at Memphis. It is thought this Menes reigned 117 years after the birth of Phaleg, ſon of Heber, which was the very year of the diſperſion of the people throughout the whole earth. In building Memphis he ſtopped the Nile near it, by the invention of a cauſeway 100 furlongs broad, and cauſed it to run through the mountains.

MENESTRIER (John Baptiſt le), a native of Dijon, and one of the moſt learned and curious French antiquaries of his time, wrote, 1. A Treatiſe on the Medals, Money, and Ancient Monuments, of the Roman Empreſſes, in folio. 2. The moſt famous Medals of the Ancient Roman Emperors and Empreſſes, in quarto. He died in 1634, aged 70.

MENGS (Anthony Raphael), firſt painter to the king of Spain, was born at Auſſig in Bohemia, A. D. 1728. His father, painter to Auguſtus III. king of Poland, perceiving his ſuperior talents, carried him from Dreſden to Rome in 1741. After having there purſued his art for four years, and copied the principal monuments of that capital, he returned to Dreſden, where he executed different works for Auguſtus with very uncommon ſucceſs. During his abode in Italy, he became acquainted with Don Carlos king of Naples; and when this prince ſucceeded to the crown of Spain in 1761, he was careful to engage Mengs in his ſervice, by granting him an yearly penſion of 2000 doubloons, together with a houſe and equipage. He lived, however, chiefly at Rome; where in 1779 he fell a ſacrifice to his confidence in a German quack, who pretended to cure him of a diſeaſe which he had contracted partly by his intenſe application, and partly by grief for the loſs of his wife. His natural timidity and great ignorance of the world, the diſtruſt which ſeemed to be expreſſed in his air and manners, and his melancholy conſtitution of body, by no means leſſened the envy of his rivals. Under this rude appearance, he had a heart full of kindneſs and humanity. On one occaſion, when he perceived that he had offended a certain perſon by his bluntneſs (excuſable only in a great genius), he was not only ſorry for his inattention, but he aſſiſted with his advice the painter whom he had offended. He made no myſtery of his art any more than his ſentiments. Clement XIV. ſubmitted to his judgment ſome pictures of no great value, and in excuſe told him that he had bought them at the recommendation of an eminent painter. "This man and I (replied Mengs) are two artiſts, one of whom praiſes every thing which he cannot equal, and the other blames every thing which he can ſurpaſs." His

manners were pure and ſimple, and enthuſiaſm for the arts had almoſt extinguiſhed in him every other paſſion. He was a good huſband and a good father; and his family could reproach him with nothing but want of economy and unbounded generoſity. Although he had received during the laſt 18 years of his life more than 250.000 livres, he hardly left wherewithal to defray the expences of his funeral. The king of Spain adopted his five daughters, and granted penſions to his two ſons. His chief works in the line of his profeſſion are at Madrid and at Rome. A catalogue of them is to be found in the account of his life prefixed to his whole works, in 2 vols 4to, publiſhed at Parma in 1780 by the Chevalier d' Azara, with notes. The firſt volume contains, 1. Reflections on the *beautiful*, and on taſte in painting. 2. Reflections on Raphael, Corregio, Titian, &c. 3. On the means of promoting the cultivation of the fine arts in Spain.—The ſecond volume contains, 1. Two letters on the group of Niobé. 2. A letter on the origin, progreſs, and decline of drawing. 3. A letter on the principal paintings at Madrid. 4. Memoirs of the life and works of Correggio. 5. Memoirs concerning the academy of fine arts at Madrid. 6. Practical leſſons in painting. Part of his works have been tranſlated into French by M. Doray de Longrais, and publiſhed at Paris 1782 in 8vo. A collection of them was lately publiſhed in 4to, 2 vols, 1787.—Mengs placed Raphael at the head of modern painters for deſign and expreſſion, Corregio for gracefulneſs of attitude and the *claro obſcuro*, and Titian for colouring. He formed his own ſtyle upon the different excellencies of thoſe three artiſts. He united the moſt ſublime expreſſion to the trueſt colouring, and to that knowledge of different effects which captivates the ſenſes at the firſt impreſſion, and which will bear the moſt rigid examination. His paintings poſſeſs chiefly that grace which one feels without being able to explain. Nobody ever ſtudied the ancients with greater care than he did. The technical part in *l'Hiſtoire de l'Art*, by his friend the Abbé Winckelman, is of his compoſition. He reſpected and admired the ancients; but he was deſtitute of that exceſſive zeal which makes their votaries conceal thoſe faults which they perceive.

MENIALS, domeſtic or houſehold ſervants, who live under their lord or maſter's roof.

MENINGES, or MENYNGES, in anatomy, a name given to the dura and pia mater of the brain. See ANATOMY, n° 126.

MENINX, an iſland in the Mediterranean, to the weſt of the Syrtis Minor. Suppoſed by Strabo and Polybius to be Homer's country of the Lotophagi; and hence Ptolomy and Eratoſthenes denominate the iſland *Lotophagitis*, with a cognominal town *Meninx*. It was the country of Vibius Gallus the emperor, and of Voluſianus. Now called *Gerbi* and *Zarbi*.

MENIPPUS, a cynic philoſopher of Phœnicia. He was originally a ſlave, but obtained his liberty with a ſum of money, and became one of the greateſt uſurers at Thebes. He grew ſo deſperate from the continual reproaches and inſults to which he was daily expoſed on account of his meanneſs, that he deſtroyed himſelf. He wrote 14 books of ſatires, which have been loſt,

MENIPPEAN (*ſatira* MENIPPEA), a kind of ſatire conſiſting of proſe and verſe intermixed. It is thus called from Menippus a cynic philoſopher who delighted in compoſing ſatirical letters, &c. In imitation of him, Varro alſo wrote ſatires under the title of *Satiræ Menippeæ;* whence this ſort of compoſition is alſo denominated *Varronian ſatire*.

Among the moderns there is a famous piece under this title firſt publiſhed in 1594, againſt the chiefs of the league, called alſo the *Catholicon* of Spain. It is eſteemed a maſter-peice for the time.

MENISCUS, in optics, a glaſs or lens, concave on one ſide and convex on the other; ſometimes alſo called *lunula*. See OPTICS.

MENISPERMUM, MOONSEED: A genus of the decandria order, belonging to the diœcia claſs of plants; and in the natural method ranking under the 11th order, *Sarmentaceæ*. The male has four exterior and eight interior petals; there are 16 ſtamina; the corolla of the female is the ſame as in the male; there are eight barren ſtamina, and two monoſpermous berries. There are three ſpecies, all of them climbing plants, riſing 14 feet high, and natives of warm climates; but no way remarkable for beauty. The ſeeds of a kind which grows in the Levant, being formed into a paſte, are regarded by the inhabitants as ſpecific againſt lice and cutaneous eruptions. The ſame paſte is likewiſe uſed for the purpoſe of intoxicating fiſhes. See *Coccvlvs Indicus*.

MENNITH, or MINNITH, Judges xi. 33. a town near Heſhbon (Jerome), in Arabia Petræa; in a diſtrict named *Ecoſipolis*, or *twenty-towns*, (Cellarius). There is alſo a Minnith mentioned Ezekiel xxvii. as being in a good wheat country; but whether the ſame with the foregoing is uncertain; though ſome think that the firſt Minnith lay in the country of Ammon, (Wells).

MENNONITES, a ſect in the United Provinces, in moſt reſpects the ſame with thoſe in other places called *Anabaptiſts*.

They had their riſe in 1536, when Menno-Simon, a native of Frieſland, who had been a Romiſh prieſt, and a notorious profligate, reſigned his rank and office in the Romiſh church, and publicly embraced the communion of the Anabaptiſts.

Menno was born at Witmarſum, a village in the neighbourhood of Balſwert in Frieſland in the year 1505, and died in 1561 in the duchy of Holſtein, at the country ſeat of a certain nobleman not far from the city of Oldeſloe, who, moved with compaſſion by a view of the perils to which Menno was expoſed, and the ſnares that were daily laid for his ruin, took him with certain of his aſſociates into his protection, and gave him an aſylum. The writings of Menno, which are almoſt all compoſed in the Dutch language, were publiſhed in folio at Amſterdam in the year 1651. About the year 1537, Menno was earneſtly ſolicited by many of the ſect with which he connected himſelf, to aſſume among them the rank and functions of a public teacher; and as he looked upon the perſons who made this propoſal to be exempt from the fanatical phrenzy of their brethern at Munſter (though according to other accounts they were originally of the ſame ſtamp, only rendered ſomewhat wiſer by their ſufferings), he yielde d to their intreaties. From this period to the end of his life, he travelled from one country

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country to another with his wife and children exercising his ministry, under pressures and calamities of various kinds, that succeeded each other without interruption, and constantly exposed to the danger of falling a victim to the severity of the laws. East and West Friesland, together with the province of Groningen, were first visited by this zealous apostle of the Anabaptists; from whence he directed his course into Holland, Gelderland, Brabant, and Westphalia, continued it through the German provinces that lie on the coasts of the Baltic Sea, and penetrated so far as Livonia. In all these places his ministerial labours were attended with remarkable success, and added to his sect a prodigious number of followers. Hence he is deservedly considered as the common chief of almost all the *Anabaptists*, and the parent of the sect that still subsists under that denomination. Menno was a man of genius, undirected by a very sound judgment; he possessed a natural and persuasive eloquence, and such a degree of learning as made him pass for an oracle in the estimation of the multitude. He appears, moreover, to have been a man of probity, of a meek and tractable spirit, gentle in his manners, pliable and obsequious in his commerce with persons of all ranks and characters, and extremely zealous in promoting practical religion and virtue, which he recommended by his example as well as by his precepts. The plan of doctrine and discipline drawn up by Menno was of a much more mild and moderate nature than that of the furious and fanatical ANABAPTISTS, whose tumultuous proceedings have been recited under that article, but somewhat more severe though more clear and consistent than the doctrine of the wiser branches of that sect, who aimed at nothing more than the restoration of the Christian church to its primitive purity. Accordingly he condemned the plan of ecclesiastical discipline that was founded on the prospect of a new kingdom, to be miracuously established by Jesus Christ on the ruins of civil government and the destruction of human rulers, and which had been the fatal and pestilential source of such dreadful commotions, such execrable rebellions, and such enormous crimes. He declared publicly his dislike of that doctrine, which pointed out the approach of a marvellous reformation in the church by the means of a new and extraordinary effusion of the Holy Spirit. He expressed his abhorrence of the licentious tenets, which several of the Anabaptists had maintained, with respect to the lawfulness of polygamy and divorce; and finally, considered as unworthy of toleration those fanatics who were of opinion that the Holy Ghost continued to descend into the minds of many chosen believers, in as extraordinary a manner as he did at the first establishment of the Christian church, and that he testified this peculiar presence to several of the faithful by miracles, predictions, dreams, and visions of various kinds. He retained indeed the doctrines commonly received among the Anabaptists, in relation to the baptism of infants, the *millenium*, or 1000 years reign of Christ upon earth, the exclusion of magistrates from the Christian church, the abolition of war, and the prohibition of oaths enjoined by our Saviour, and the vanity as well as the pernicious effects of human science. But while Menno retained these doctrines in a general sense, he explained and modified them in such a manner as made them resemble the religious tenets that were universally received in the Protestant churches; and this rendered them agreeable to many, and made them appear inoffensive even to numbers who had no inclination to embrace them. It however so happened, that the nature of the doctrines considered in themselves, the eloquence, of Menno which set them off to such advantage, and the circumstances of the times, gave a high degree of credit to the religious system of this famous teacher among the Anabaptists, so that it made a rapid progress in that sect. And thus it was in consequence of the ministry of Menno, that the different sorts of Anabaptists agreed together in excluding from their communion the fanatics that dishonoured it, and in renouncing all tenets that were detrimental to the authority of civil government, and by an unexpected coalition formed themselves into one community.

Though the Mennonites usually pass for a sect of Anabaptists, yet M. Herman Schyn, a Mennonite minister, who has published their history and apology, maintains, that they are not Anabaptists either in principle or by origin. However, nothing can be more certain than this fact, viz. that the first Mennonite congregations were composed of the different sorts of Anabaptists, of those who had been always inoffensive and upright, and of those who, before their conversion by the ministry of Menno, had been seditious fanatics: besides it is alledged, that the Mennonites do actually retain, at this day, some of those opinions and doctrines, which led the seditious and turbulent Anabaptists of old to the commission of so many and such enormous crimes: such particularly is the doctrine concerning the nature of Christ's kingdom, or of the church of the New Testament, though modified in such a manner as to have lost its noxious qualities, and to be no longer pernicious in its influence.

The Mennonites are subdivided into several sects; whereof the two principal are the *Flandrians* or FLEMINGIANS, and the WATERLANDIANS. The opinions, says Mosheim, that are held in common by the Mennonites, seem to be all derived from this fundamental principle, that the kingdom which Christ established upon earth is a visible church or community, into which the holy and just alone are to be admitted, and which is consequently exempt from all those institutions and rules of discipline that have been invented by human wisdom, for the correction and reformation of the wicked. This principle, indeed, was avowed by the ancient Mennonites, but it is now almost wholly renounced: nevertheless, from this ancient doctrine, many of the religious opinions that distinguish the Mennonites from all other Christian communities, seem to be derived: in consequence of this doctrine, they admit none to the sacrament of baptism but persons that are come to the full use of their reason; they neither admit civil rulers into their communion, nor allow any of their members to perform the functions of magistracy; they deny the lawfulness of repelling force by force, and consider war, in all its shapes, as unchristian and unjust; they entertain the utmost aversion to the excution of justice, and more especially,

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especially to capital punishments; and they also refuse to confirm their testimony by an oath. The particular sentiments that divided the more considerable societies of the Mennonites are the following: The rigid Mennonites, called the *Flemingians*, maintain, with various degrees of rigour, the opinions of their founder Menno, as to the human nature of Christ, alledging that it was produced in the womb of the Virgin by the creating power of the holy Ghost; the obligation that binds us to wash the feet of strangers, in consequence of our Saviour's command; the necessity of excommunicating and avoiding, as one would do the plague, not only avowed sinners, but also all those who depart, even in some light instances pertaining to dress, &c. from the simplicity of their ancestors; the contempt due to human learning, and other matters of less moment. However this austere system declines, and the rigid Mennonites are gradually approaching towards the opinions and discipline of the more moderate or *Waterlandians*.

The first settlement of the Mennonites, in the United Provinces, was granted them by William prince of Orange, towards the close of the 16th century; but it was not before the following century that their liberty and tranquillity were fixed upon solid foundations, when, by a confession of faith published in the year 1626, they cleared themselves from the imputations of those pernicious and detestable errors that had been laid to their charge. In order to appease their intestine discords, a considerable part of the Anabaptists of Flanders, Germany, and Friesland, concluded their debates in a conference held at Amsterdam, in the year 1630, and entered into the bonds of fraternal communion, each reserving to themselves a liberty of retaining certain opinions. This association was renewed and confirmed by new resolutions, in the year 1649; in consequence of which the rigorous laws of Menno and his successors were, in various respects, mitigated and corrected.

MENOCHIUS, vulgarly MENOCHIA, (James), a famous lawyer, meanly born at Pavia, but who became so skilful in the law, that he was called the *Baldus* and *Bartholus* of his age; all the princes of Italy soliciting him to their universities. He read at Padua 23 years together; and for love of his country removed to Pavia, and succeeded Nicholas Gratiani. He hath got an immortal fame by his works, *De recuperanda possessione; De adipiscenda possessione; De presumptionibus; De arbitrariis Judicum questionibus & causis conciliorum*, tom. 13. &c. He died in 1607, aged 75.

MENOLOGY MENOLOGIUM, (from μὴν, *month*, and λόγος, *discourse*), is much the same as martyrology, or callendar, in the Latin.

The Greek menologium is divided into the several months in the year; and contains an abridgement of the lives of the saints, with a bare commemoration of the names of such whose lives were never written. The Greeks have various menologies; and the Romans tax them with inserting divers heretics in their menologies as saints.—Baillet treats of them at large.

MENSA, in law-books, a term that includes in it all patrimony, and necessaries for livelihood.

MENSALS, MENSALIA, in church-history, such livings as were formerly united to the tables of religious houses, and hence called *mensal benefices*. See the article BENEFICE.

Menses.

MENSES, CATAMENIA, in medicine, the monthly evacuations from the uterus of women not with child or not giving suck. They are so called from *mensis* "month," the period wherein they return. They are also called *flowers*, *courses*, &c. By the Jewish law a woman was unclean while the menstrual blood flowed; and the man who touched her, or the moveables she had touched, was declared unclean.—Levit. xv.

The menses make one of the most curious and difficult phenomena in the whole human body; for the explanation whereof, many hypotheses have been framed, though the matter is yet scarcely ascertained.

It is generally agreed by all, that the necessity women are under for some extraordinary supply to compensate the expence, and support them during the time of gestation, was the final reason why this redundance at other times was given them, which continues whilst this necessity subsists, and ceases when, according to the constitution of the female frame, it is no longer required: but this is all they agree in. Some, not content with this occasion alone, will have the menstruous blood offend in quality more than quantity; which they argue from the pain it gives many women in the evacuation; with many other idle notions.

Others ascribe this effect to an imaginary dominion of the moon over the bodies of women. This was formerly the prevailing opinion; though the smallest reflection would have shown the weakness of it: for, had this purgation been owing to the influence of the moon, all women of the same age and temperament would have found it at the same periods and revolutions of the moon, *i. e.* at the same time; which all experience shows to be false.

There are two other opinions which carry with them great probability, and are argued with a great deal of strength and reason; in both which, the quality of the blood is allowed to be innocent, but they still differ about the reason of its issue. The former is that of Dr Bohn and Dr Friend, who maintain this flux to be the result of a plethora or plenitude; and to be evacuated only for relief against the quantity.

Dr Friend, who has maintained the cause of a plethora with the greatest strength and clearness, supposes, that this plethora arises from a coacervation in the blood-vessels of a superfluity of aliment, which, he thinks, remains over and above what is expended by the ordinary ways; and that women have this plethora, and not men, because their bodies are more humid, and their vessels, especially the extremities of them, more tender, and their manner of living generally more inactive than that of men; and that these things concurring, are the occasion that women do not perspire sufficiently to carry off the superfluous alimentary parts, till they be accumulated in such quantities as to distend the vessels, and force their way thro' the capillary arteries of the uterus. It is supposed to happen to women more than the females of other species, which have the same parts, because of the erect posture of the former, and the

Menses. the vagina and other canals being perpendicular to the horizon; so that the pressure of the blood is directed towards their orifices; whereas in brutes, they are parallel to the horizon, and the pressure wholly is on the sides of those vessels. The discharge, he thinks, happens in this part rather than in any other, as being more favoured by the structure of the vessels; the arteries being very numerous, and the veins sinous and winding, and therefore more apt to retard the impetus of the blood; and consequently, in a plethoric case, to occasion the rupture of the extremities of the vessels, which may last, till, by a sufficient discharge, the vessels are eased of their overload.

This is the substance of Dr Freind's theory; from whence he very mechanically and very philosophically accounts for the symptoms.

To his argument, why women have menses rather than men, we may add from Boerhave, that, in the former, the *os sacrum* is wider, and stands farther out, and the *os coccyges* farther in; the *ossa innominata* wider, and farther apart, and the lowest of them, as well as the lower eminences of the *os pubis*, farther outwards than in the latter. Hence, in women, the latitude or expansion about these bones, and the capacity of the *pelvis*, is vastly great in proportion to those of men; and yet, in a woman not pregnant, there is not much to fill this expanse. Again, the foreside of the thorax is smoother in women than in men and the blood-vessels, lymphatics, adipose, and nervous vessels, membranes, and fibres, are much laxer in women than in men: whence all their cavities, cells, vessels. &c. are more easily replenished, and the humours aggregated in them; besides, that they are found to perspire less than men, and to arrive much sooner at their maturity, or ακμη of increase. To which he adds the consideration of the soft pulpous texture of the uterus and the vast number of veins and arteries with which it is filled. Hence a healthy maid, being arrived at her growth, begins to prepare more nutriment than is required for the support of the body; which, as there is not to be any farther accretion, must of necessity fill the vessels, and especially those of the uterus and breasts, they being the least compressed. These will be dilated more than the others; whence the lateral vascules evacuating their humour into the cavity of the uterus, it will be filled and extended. Hence a pain, heat, and heaviness, will be felt about the loins, pubes, &c. the vessels of the uterus, at the same time, will be so dilated as to emit blood into the cavity of the uterus, and its mouth will be lubricated and loosened, and blood issue out. As the quantity of blood is diminished, the vessels will be less pressed, and will contract themselves again closer, so as again to retain the blood, and let pass the grosser part of the serum; till at length only the usual serum passes. Again, there are more humours prepared, which are more easily lodged in vessels once dilated; and hence the menses go and return at various periods in various persons.

This hypothesis, however plausible, is opposed by Dr Drake, who maintains, that there is no such repletion, or at least that it is not necessary to menstruation, arguing, that, if the menses were owing to a plethora so accumulated, the symptoms would arise gradually, and the heaviness, stiffness, and inactivity, necessary symptoms of a plethora, would be felt long before the periods were completed, and women would begin to be heavy and indisposed soon after evacuation, and the symptoms would increase daily; which is contrary to all experience, many women, who have them regularly and easily, having no warning, nor any other rule to prevent an indecent surprise, than the measure of the time; in which, some that have slipped, have been put to confusion and shifts no ways consistent with the notice a plethoric body would give. He adds, that even in those who are difficultly purged this way, the symptoms, though very vexatious and tedious, do not make such regular approaches as a gradual accumulation necessarily requires. If we consider what violent symptoms come on in an hour, we shall be extremely puzzled to find the mighty accession of matter, which should, in an hour or a day's time, make such great alterations. According to the hypothesis, the last hour contributed no more than the first; and of consequence, the alteration should not be greater in the one than in the other, setting aside the bare eruption.

This is the substance of what is argued against Dr Freind's theory: which, is must be owned, notwithstanding these objections, is still the most rational and consistent that has yet been advanced.

Those who oppose it, give into the doctrine of fermentation, and maintain the evacuation of blood in those parts to be an effect of an effervescence or ebullition of the blood. This opinion has been maintained by many, particularly by Dr Charleton, Bale, De Graaf, and Drake; the two first of whom suppose a ferment peculiar to the women, which produces this flux, and affects that part only, or at least principally. Dr Graaf, less particular in his notion, only supposes an effervescence of the blood, raised by some ferment, without assigning how it acts, or what it is. The sudden turgescence of the blood occasioned them all to think, that it arose from something till then extraneous to the blood, and led them to the parts principally affected to seek for an imaginary ferment, which no anatomical inquiry could ever show, or find any receptacle for, nor any reasoning necessarily infer. Again, that heat which frequently accompanies this turgescence, led them to think the case more than a plethora, and that there was some extraordinary intestine motion at that time,

Dr Drake improves on the doctrine of a ferment; and contends, not only that it is necessary there should be a ferment, but a receptacle also for this ferment; concluding, from the suddenness and violence of the symptoms, that a great quantity must be conveyed into the blood in a short time, and consequently, that it must have been ready gathered in some receptacle, where, while it was lodged, its action was restrained. But he goes farther still, and pretends to ascertain the place, &c. both of the one and the other, making the gall-bladder to be the receptacle, and the bile the ferment. This liquor he thinks well adapted to raise a fermentation in the blood, when discharged into it in a quantity; and, as it is contained in a receptacle that does not admit of a continual issue, it may be there reserved, till in a certain period of time the

the bladder becoming turgid and full, through the compression of the incumbent viscera, it emits the gall; which, by the way of the lacteals, insinuating itself into the blood, may raise that effervescence which occasions the rupture of the uterine arteries. To confirm this, he alledges, that persons of a bilious constitution have the menses either more plentifully, or more frequently, than others; and that distempers manifestly bilious, are attended with symptoms resembling those of women labouring under difficult menstruation. —If it be objected, that on this principle men should have menses as well as women, he answers, that men do not abound in bile so much as women, the pores of the former being more open, and carrying off more of the serous part of the blood, which is the vehicle of all the other humours, and consequently a greater part of each is discharged through them than in women, wherein the superfluity must either continue to circulate with the blood, or be gathered into proper receptacles, which is the case in the bile. The same reason he gives why menstruation should not be in brutes: the pores of these being manifestly more open than those of women, as appears from the quantity of hair which they bear, for the vegetation whereof a large cavity, and a wider aperture of the glands, is necessary, than where no such thing is produced: yet there is some difference between the males and females even among these, some of the latter having their menses, though not so often, nor in the same form and quantity, as women.

He adds, that the several phenomena of the menses, whether in a natural, a regular, or diseased case, flow naturally and readily from this hypothesis; and that whatever may be accounted for from a plethora, or from any particular ferment, may without any straining be applied to this.

Females generally begin to menstruate about the age of fourteen or fifteen, and cease about fifty; though instances have occurred of their commencing sooner and continuing longer. There are, therefore, two critical periods in the lives of females which require their particular attention. In order to escape the chlorosis, and other similar diseases, incident to that period of life when the menses commence, they should avoid indolence and inactivity, and accustom themselves to exercise in the open air as much as possible. Unwholesome food, dulness of disposition, and strait cloaths, are very injurious to females at this season. The discharge in the beginning is seldom so instantaneous as to surprise them unawares. The eruption is generally preceded by symptoms that indicate its approach; such as a sense of heat, weight, and dull pain in the loins; distension and hardness of the breasts, head-ach, loss of appetite, lassitude, paleness of the countenance and sometimes a slight degree of fever. When these symptoms occur, every thing should be carefully avoided which may obstruct the menstrual flux, and all means used to promote it; as sitting frequently over the steams of warm water, drinking warm diluting liquors, &c. When the menses have begun to flow great care should be taken to avoid every thing that tends to obstruct them; such as fish, and all kinds of food that are hard of digestion, and cold acid liquors. Cold is likewise hurtful at this period; as also anger, fear, grief, and other affections of the mind. From whatever cause this flux is obstructed, except in the state of pregnancy, proper means should be used to restore it; and if exercise in a dry, open, and rather cool air, wholesome diet, generous liquors in a weak and languid state of the body, chearful company, and amusement fail, recourse must be had to medicine.— When obstructions proceed from a weak relaxed state of the solids, such medicines as tend to promote digestion, to brace the solids, and assist the body in preparing good blood, ought to be used. See *Medicine-Index*.

When the menstrual flux is too great, the patient becomes weak, the colour pale, the appetite and digestion are bad, and œdematous swellings of the feet, dropsies, and consumptions, often ensue. This frequently happens to women about the age of forty-five or fifty, and is very difficult of cure. It may proceed from a sedentary life; a full diet, consisting chiefly of salted, high seasoned, or acrid food; the use of spirituous liquors; excessive fatigue; relaxation; a dissolved state of the blood; violent passions of the mind, &c. In order to restrain the flux, the patient should be kept easy both in body and mind. If it be very violent, she ought to lie in bed with her head low; to live upon a cool and slender diet, as veal or chicken-broths with bread, and to drink decoctions of nettle-roots or the greater comfrey. If these fail, recourse must be had to stronger astringents, &c. See Medicine n° 246.

The discharge of the menses is interrupted naturally during pregnancy: but this is not always the case, because some have them three months, some six months, and some during the whole time of gestation, though in less quantity than at other times. The menses are mostly interrupted during the time of giving suck, though many women have a return about the third or fourth month after delivery, and almost all have them again in the ninth or tenth month. In cases of obstruction, the menstrual blood hath discharged itself by other outlets.

It usually happens that this periodical discharge ceases between the age of forty and fifty; and the season in which this takes place is critical to the sex.— However, those who survive this period without contracting any chronical disease, become more healthy and vigorous than they were before. About this time, some are afflicted with the well known symptoms of plethora, heat, flushings, restless nights, troublesome dreams, and unequal spirits; others are attacked with inflammations of the bowels, or other internal parts; spasmodic affections of various parts, stiffness in the limbs, swelled ancles, with pain and inflammation, the piles, and other effects of plenitude. Those of full plethoric habits, accustomed to copious evacuations, will find great relief by bleeding frequently in moderate quantities, keeping the bowels lax, moderating their diet, and using sufficient exercise that is not too heating. If an immoderate flux of the menses happen at this period, it should be restrained by gentle laxatives, cooling medicines, rest, anodynes, a more sparing not too liquid diet, rather than by very copious bleedings and astringents of any kind. Dr Fothergill observes, that various purgations of aloes, the tinctura sacra, pil. Ruffi, elixir proprietatis, and other compositions of this kind, are recommended as proper purgatives

purgatives to be used on the cessation of the menses. But many inconveniences have arisen from these heating medicines, as the piles, strangury, immoderate discharges of the menses, racking pains in the loins, and other similar complaints. Rhubarb, sena, magnesia, sulphur medicines, small doses of jalap, and various combinations of these, may be substituted in the room of the others, and will supply sufficient variety to the prescriber and patient. When the menses are about to go off, they appear for the most part irregularly both in time and quantity; once in a fortnight, three, five, or six weeks; sometimes very sparingly, at other times in immoderate quantities. Great losses of this kind are often prevented by taking away four or five ounces of blood a few days after the first menstrual suppression. If a patient has in early life been subject to cutaneous eruptions, sore eyes, glandular swellings, or other obvious marks of morbid humours subsisting in the constitution, and all which may have disappeared about the time the menses became regular, an issue is an advisable drain, and may prevent many inconveniences. If at this time ulcerous sores break out about the ancles, or in other parts of the body, they ought to be continued open, or artificial drains substituted in their stead; for those who will have them dried up are soon after carried off by acute diseases, or fall into those of a chronic nature.

MENSORES, among the Romans, were harbingers, whose business it was to go before the emperor, and fix upon lodgings for him when he travelled into any of the provinces. They also marked out encampments, and assigned every regiment its post.

Mensores were also land-surveyors, architects, or appraisers of houses and public buildings. The distributors of provisions in the army were called *mensores frumentarii*. And mensores was also an appellation given to servants who waited at table.

MENSTRUAL, or MENSTRUOUS, a term in medicine, applied to the blood which flows from women in their ordinary monthly purgations. See MENSES.

MENSTRUUM, in chemistry, any body which in a fluid or subtilised state is capable of interposing its small parts betwixt the small parts of other bodies, so as to divide them subtilly and form a new uniform compound of the two.

MENSURATION, in general, denotes the act or art of measuring lines, superficies or solids. See GEOMETRY.

MENTHA, MINT, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order *Verticillatæ*. The corolla is nearly equal, and quadrifid, with one segment broader than the rest, and emarginated; the stamina are erect, standing asunder. There are many species; but not more than three are cultivated for use, namely, the viridis or common spearmint, the piperita or peppermint, and the pulegium or pennyroyal. All these are so well known as to need no description; and all of them are very easily propagated by cuttings, parting the roots, or by offsets.

Uses. For culinary purposes, the spearmint is preferable to the other two; but for medicine, the peppermint and pennyroyal have in some places almost entirely superseded it. A conserve of the leaves is very grateful, and the distilled waters both simple and spirituous are universally thought pleasant. The leaves are used in spring sallads; and the juice of them boiled up with sugar is formed into tablets. It has been imagined that cataplasms and fomentations of mint, would dissolve coagulations of milk in the breasts; but Dr Lewis says, that the curd of milk, digested in a strong infusion of mint, could not be perceived to be any otherwise affected than by common water: however, milk, in which mint-leaves were set to macerate, did not coagulate near so soon as an equal quantity of the same milk kept by itself. Dr Lewis says, that dry mint digested in rectified spirits of wine, gives out a tincture, which appears by day-light of a fine dark green, but by candle-light of a bright red colour. The fact is, that a small quantity of this tincture is green either by day-light or by candle-light, but a large quantity of it seems impervious to common day-light; however, when held betwixt the eye and a candle, or betwixt the eye and the sun, it appears red.

The virtues of mint are those of a warm stomachic and carminative: in loss of appetite, nausea, and continual retching to vomit, there are few simples of equal efficacy. In colicky pains, the gripes to which children are subject, lienteries, and other immoderate fluxes, this plant frequently does good service. It likewise proves beneficial in many hysteric cases, and affords an useful cordial in languors and other weaknesses consequent upon delivery. The best preparation in these cases is a strong infusion of the dried herb in water (which is much superior to the green), or rather a tincture or extract prepared with rectified spirit. These possess the whole virtues of the mint; the essential oil and distilled water contain only the aromatic part; the expressed juice only the astringency and bitterishness, together with the mucilaginous substance common to all vegetables. The peppermint is much more pungent than the others.

Pennyroyal has the same general characters with the mint, but is more acrid and less agreeable when taken into the stomach. It has long been held in great esteem, and not undeservedly, as an aperient and deobstruent, particularly in hysteric complaints and suppressions of the menses. For these purposes the distilled water is generally made use of, or, what is of equal efficacy, an infusion of the leaves. It is observable, that both water and rectified spirit extract the virtues of this herb by infusion, and likewise elevate the greatest part of them by distillation. The expressed juice, with a little sugar, is not a bad medicine in the chincough.

MENTOR (fab. hist.), a faithful friend of Ulysses; a son of Hercules; a king of Sidonia, who revolted against Artaxerxes Ochus, and afterwards was restored to favour by his treachery to his allies, &c. *Diod.* 16. An excellent artist in polishing cups and engraving flowers on them. *Plin.* 33. c. 11.—*Mart.* 9. ep. 60. v. 16.

MENTZ, an archbishopric and electorate in Germany. It lies on the banks of the river Mayne, between the electorate of Triers on the west, the Palatinate on the south, Franconia on the east, and the Wetteraw on

Mentz. on the north. It is about 60 miles in length from north-east to south-west, and about 50 in breadth. A considerable part of the elector's revenue arises from the toll on the Rhine and the Mayne, and from the tax on the excellent wines produced in this country. The chief towns of any trade are, 1. Mentz; (see the next article.) In its neighbourhood is Hockheim, so celebrated for good wines, that the best Rhenish is from thence called *old hock*. It is a pretty village, containing about 300 families; and belongs to the chapter of Mentz, the dean of which enjoys the revenue of it: in a good year he makes from twelve to fifteen thousand guilders of his wine. He and the Augustines of Mentz and Francfort have the exclusive enjoyment of the best Hockheimer wine, of which, in good years, a piece, consisting of 100 measures, sells for from 900 to 1000 guilders from the press. "This (says the Baron Riesbeck) is certainly one of the dearest wines in the world. Having a desire to taste it on the spot, we were obliged to pay a rix-dollar; it was, however, of the best vintage in this century, viz. that of 1766. Nor should we have had it, but for an advocate of Mentz, to whom the hostess meant to show favour. This was the first German wine I had met with which was entirely without any sour taste: it was, quite a perfume to the tongue; whereas the other wine of Hockheim, let it be as good as it may, is not quite clear of vinegar; though for this also, if it has any age, you are forced to pay a guilder and a half." 2. Bingen is a pleasant town, which stands in the district called *Rhinegau*. This town, which, together with the toll on the Rhine, is worth about 30,000 guilders, belongs to the chapter of Mentz, is extremely beautiful, and contains about 4500 inhabitants. A great part of the corn which is carried into the Rhinegau from the neighbouring Palatinate, comes through this place, which, on the other hand, supplies the Palatinate with drugs, and various foreign commodities. This traffic alone would make the place very lively; but besides this, it has very fruitful vineyards. The hill, at the foot of which it lies, and one side of which is made by the gullet, through which the Nahe runs into the Rhine, forms another steep rock behind this gullet parallel to the Rhine and the golden Rudesheimer mountain; it therefore enjoys the same sun as this does, which makes the Rudesheimer wine that grows on it little inferior to the Rudesheimer. See RUDESHEIM. The rising grounds about it produce wines that are esteemed preferable to those of Baccharach, so much in vogue heretofore.—2. Elfeld, five miles west from Mentz, is a strong fortified town, on the north-side of the Rhine, and the chief of the Rhinegau.—Here is Rudesheim, a place noted for the growth of the best wines in these parts. 4. Weisbaden lies between six and seven leagues from Francfort, and about five or six miles north of Mentz; it is the metropolis of a country belonging to the branch of Nassau-Saarbrak, and is famous for its mineral waters.

After the pope, there is no doubt but the archbishop of this place is the most considerable and richest prelate in the Christian world. According to Baron Riesbeck, the see is indebted for its increase of riches to St Boniface, who may be called, with great justice, the apostle of the Germans. It was this man, an Englishman by birth, who in the time of Charlemagne baptized Witikind and the other brave Saxons who had so long resisted baptism with their swords, and spread the empire of the vicar of Jesus Christ as far as the northern and eastern seas. He it was who introduced the Roman liturgy into Germany, and made the savage inhabitants abstain from eating horse's flesh. He raised the papal power to a higher pitch than it had been raised in any other country in Christendom; and, in recompence of his services the pope made all the new-founded bishoprics in the north of Germany subject to the see of Mentz, which Boniface had chosen for his residence. The provinces, the most considerable in the whole papal dominions, all Swabia, Franconia, Bohemia, and almost all Saxony, with a part of Switzerland, Bavaria, and the upper Rhine, belong to this diocese. Though the reformation, and revenge of the kings of Bohemia, have lessened it one third, it still contains the archbishopric, of Sprengel and eleven bishoprics, most of which are the most considerable of Germany, as Wurzburg, Paderborn, Hildesheim, Augsbourg, &c. When the building of the papal monarchy was completed by Gregory VII. the archbishops of Mentz became powerful enough to be at the head of the empire. In the 13th and 14th centuries, they were so eminent as to be able to make emperors without any foreign assistance; and it was to one of them that the house of Hapsburg was indebted for its first elevation. Since the boundaries of the two powers have been more accurately ascertained, and the temporal has so much got the better of the spiritual, the power and influence of the archbishops of this place have of course been much reduced; still, however, they are possessed of very important prerogatives, which they might exert with much more efficacy than they do, were it not that various circumstances have rendered them too dependant on the emperors. They are still the speakers in the Electoral College, have the appointment of the diets under the emperors, and may order a re-examination of the proceedings of the imperial courts. These high privileges are, however, too much subject to the controul of the house of Austria; nor are their spiritual powers any longer what they once were. Their suffragan bishops have taken it into their heads that all bishops are alike as to power, and that the title of archbishop only intitles its possessor to the first place amongst brothers who are equal. The temporals, however, which are still annexed to this chair, make him who sits in it rich amends for the diminution of his spiritual and political splendor. Though he does not absolutely possess the largest, yet he certainly has the richest and most peopled domain of any ecclesiastical potentate in Germany. The country, it is true, does not contain more than 125 German miles square, whereas the archbishopric of Saltzburg contains 240; but then Saltzburg has only 250,000 inhabitants, whereas Mentz has 320,000. The natural riches of the territory of Mentz, and its advantageous situation, make a subject of Mentz much richer than one of Saltzburg, the greatest part of which is only inhabited by herdsmen. In the territory of Mentz there are 40 cities; in that of Saltzburg only seven. The tax on vessels which go down the Rhine of itself produces 60,000 guilders, or 6000 l. a year, which is nearly

Mentz.

nearly as much as all the mines of Saltzburg put together, excepting only the ſalt mine at Halle. The tax on wine, here and in the country round, produces the court above 100,000 guilders, or 10,000 l. a-year in which ſum we do not reckon the cuſtoms of the countries which lie at a greater diſtance. Upon the whole, the income of the preſent archbiſhop may be valued at 1,700,000 guilders, or 1700,000 l.

If the lands of the elector lay all together, they would produce a ſufficiency of corn and all the prime neceſſaries of life; but as ſeveral parts of them lie wide aſunder, the people are compelled to purchaſe a great deal from foreigners. The capital itſelf, as well as the adjacent Rhinegau, depends on the Palatinate for its corn, notwithſtanding the great abundance of that and every other ſpecies of grain in its own poſſeſſions in Wetterau. The nobleſt production of the elector's territory on the Rhine is the wine, which is almoſt the only true Rheniſh. Connoiſſeures, indeed, allow the wines of Neirſtein, Bacharach, and a very few other places out of this country, to be true Rheniſh: but they do not give this name to the wines of the Palatinate, of Bardon, and of Alſatia. There is a great deal of wine made in the countries which lie on the ſouth and weſt of the Rhine, at Laubenheim, Bodenheim, Budeſheim, and Bingen; but the true Rheniſh, that which inſpires ſo many who are and ſo many who are not poets, comes only from the Rhinegau, which lies on the northern banks of the Rhine. See RHINEGAU.

The civil liſt of the archbiſhop (according to Baron Rieſbeck), is by much too immoderate and expenſive. "He has his miniſters, his counſellors of ſtate, and eighty or ninety privy counſellors of various denominations. The expence of this eſtabliſhment is very diſproportionate to the revenue of the ſtate. This is owing to the large number of poor nobility, who can only accept of employments of this kind. Ignorance of the true principles of government are the cauſes of this evil. The conſequences are, that a great number of perſons, who might be uſefully employed, live in idleneſs. Even the military eſtabliſhment of the country appears to be more calculated for the purpoſe of feeding a hungry nobility than for real uſe. At the acceſſion of the preſent elector, though the whole army only conſiſted of 2200 men, there were ſix generals. The regular eſtabliſhment paid for and ſupported by the country is 8000 men; but though there are only 2000 men kept up, the money expended for their ſupport, particularly that given to numberleſs uſeleſs officers, might be made uſe of more for the benefit of the country. The army of the archbiſhop conſiſts of a German guard of 50 men and 25 horſes, a Swiſs guard, a ſquadron of huſſars of 130 men (the moſt uſeful troops, as they purge the land of robbers and murderers), a corps of artillery of 104 men, three regiments of infantry of 600 men each, and ſome companies belonging to the armies of Franconia and the Upper Palatinate. Of the fortifications of the capital we may ſay much the ſame as of the army. Were they, indeed, improved and kept up as they ought to be, they would vie with Luxemburg, and be the moſt powerful of all the barriers againſt France. It is true, that the nature of ground does not allow of a regular plan; but for ſingle parts, I have ſeen no place of the ſame capabilities, where greater advantages have been taken of the ground for the erection of the ſeveral works. The beauty, as well as ſize of them, is indeed an object of great wonder; but though the circle of the Upper Rhine, and even the empire in general, has laid out great ſums on the building theſe fortifications, parts of them are not finiſhed, and parts of them are ready to fall to pieces. Their extent, indeed, would require a great army to man them. But this, as well as the maintaining and keeping them up, is evidently beyond the power of this court, or indeed of the whole circle of the Upper Rhine united. They are, therefore, alſo to be looked upon as one of the things which ſerve more for magnificence than real uſe."

MENTZ, a conſiderable town of Germany, in the circle of the Lower Rhine, and capital of the electorate of the ſame name, is ſituated on the Rhine near its confluence with the Mayne, 20 miles north-weſt of Worms, 15 weſt of Francfort, and 75 eaſt of Triers, in E. Long. 8. 20. N. Lat. 49. 51. This city claims a right to the invention of the art of printing: (ſee *Hiſtory of* PRINTING). Here is a very beautiful quay along the river, defended by ſeveral works well fortified with cannon. That part of the city which extends towards the river is moſt populous. The beſt vineyards for Rheniſh wine being in this neighbourhood. Mentz has a flouriſhing trade in that commodity more particularly; and its commerce is the briſker, by reaſon that all the merchandize which paſſes up and down the Rhine ſtops in its harbour to change bottoms.

The northern part of the city, in which the archbiſhop reſides, is full of very regular buildings. Here are three regular ſtreets, called the *Blercken*, which run parallel to each other from the bank of the Rhine to 600 yards within the city, and are cut almoſt regularly by very pretty croſs ſtreets. The archbiſhop's palace has a moſt commanding view of theſe ſtreets, the Rhine and the Rhinegau. There are alſo ſome good buildings in the old part of the city. The market of beaſts is extremely well worth ſeeing: and you here and there meet with other agreeable ſpots. The market in the middle of the town, though not regular, is one of the prettieſt places in Germany. The cathedral is well worth notice. It is an immenſe large old Gothic building, the ſpire of which was ſtruck with lightning about 20 years ago, and entirely laid in aſhes. As it was made of a foreſt of wood; it burned 14 hours before it was entirely conſumed. To prevent theſe accidents for the future, the chapter had the preſent one built to the ſame height in ſtone, an undertaking which coſt them 40,000 guilders or L. 4000. It is a great pity (Baron Rieſbeck obſerves) that it is overloaded with ſmall ornaments; and a ſtill greater, that this wonderful edifice is ſo choaked up with ſhops, and houſes as to be hardly more than half viſible. As, however, houſes and ſhops are very dear in this part of the town, one cannot be very angry with the chapter for choöſing rather to make the moſt of its ground than to ſhow off the church to the beſt advantage. The rent of a ſhop and a ſingle room to live in is 150 guilders or L. 15 per annum in this part of the town.

There is hardly another church in Germany of the height and length of this cathedral; and the inside of it is decorated with several magnificent monuments of princes and other great personages. Besides the cathedral, the city of Mentz contains several other churches in the modern style, very well worth seeing. St Peter's, and the Jesuits church, though both too much loaded with ornament, are among this number. The church of the Augustines, of which the inhabitants of Mentz are so proud, is a master-peice of bad taste; but that of Ignatius, though little is said about it, would be a model of the antique, if here likewise there had not been too much ornament lavished. Upon the whole, the palaces of the noblesse want that noble simplicity which alone constitutes true beauty and magnificence. In another century the externals of the city will be quite changed. The late prince built a great deal, and the present has a taste for the same sort of expence. The monks and governors of hospitals also have been forced to rebuild their houses; so that when a few more streets are made broader and straighter, the whole will have no bad appearance. The inhabitants, who together with the garrison amount to 30,000, are a good kind of people, and, like all the catholics of Germany, make great account of a good table. Their faces are interesting, and they are not deficient either in wit or activity.

There are few cities in Germany besides Vienna which contain so rich and numerous a nobility as this does; there are some houses here which have estates of 100,000 guilders, or L. 10,000 a-year. The counts of Bassenheim, Schonborn, Stadion, Ingelheim, Elz, Ostein, and Walderdorf, and the lords of Dahlberg, Breitenbach, with some others, have incomes of from 30,000 to 100,000 guilders. Sixteen or eighteen houses have from 15,000 to 30,000 guilders annual revenue.—The nobility of this place are said to be some of the oldest and most untainted in Germany. There are amongst them many persons of extraordinary merit, who join uncommon knowledge to all the duties of active life. Upon the whole, they are far superior to the greater part of the German nobility. Their education, however, is still too stiff. The first minister of the court was refused admittance into their assemblies for not being sufficiently noble; and they think they degrade themselves by keeping company with bourgeois.

The clergy of this place are the richest in Germany. A canonry brings in 3500 Rhenish guilders in a moderate year. The canonry of the provost brings him in 40,000 guilders a-year; and each of the deaneries is worth 2600 guilders. The income of the chapter altogether amounts to 300,000 guilders. Though it is forbidden by the canons of the church for any one to have more than a single prebend, there is not an ecclesiastic in this place but what has three or four; so that there is hardly a man amongst them who has not at least 8000 guilders a-year. The last provost a count of Elts, had prebends enough to procure him an income of 75,000 guilders. Exclusive of the cathedral, there are several other choirs in which the canonries bring in from 1200 to 1500 guilders a-year. To give an idea of the riches of the monasteries of this place, Baron Riesbeck informs us, that at the destruction of the Jesuits, their wine, which was reckoned to sell extremely cheap, produced 120,000 rixdollars. A little while ago the elector abolished one Carthusian convent and two nunneries, in the holy cellars of which there was found wine for at least 500,000 rixdollars. "Notwithstanding this great wealth (continues our author), there is not a more regular clergy in all Germany. There is no diocese in which the regulations made by the council of Trent have been more strictly adhered to than they have here; the archbishops having made a particular point of it both at the time of the reformation and ever since. One thing which greatly contributes to keep up discipline is the not suffering any priest to remain in the country who has not fixed and stated duties, and a revenue annexed to them. Most of the irregularities in Bavaria, Austria, and other countries, arise from abbés who are obliged to subsist by their daily industry and any masses which they can pick up. These creatures are entirely unknown here. The theological tenets of this court are also much purer than those of any other ecclesiastical prince in Germany. I was pleased to see the Bible in the hands of so many common people, especially in the country. I was told that the reading of it was not forbidden in any part of the diocese; only persons, were enjoined not to read it through without the advice of their confessors. For a long time superstition has been hunted through its utmost recesses; and though it is not quite possible to get entirely clear of pilgrimages and wonder-working images, you will meet with no priest bold enough to exorcise or to preach such nonsense as we hear in the pulpits of other German churches."

Though the trade of this place has been constantly on the increase for these 18 or 20 years past, yet it is by no means what it ought to be from the situation and other advantages. The persons here who call themselves merchants, and who make any considerable figure, are in fact only brokers, who procure their livelihood at the expence of the country or territory round, or who act for the merchants of Francfort. A few toy-shops, five or six druggists, and four or five manufacturers of tobacco, are all that can possibly be called traders. There is not a banker in the whole town; and yet this country enjoys the staple privilege, and commands by means of the Mayne, Necker, and Rhine, all the exports and imports of Alsatia, the Palatinate, Franconia, and a part of Suabia and Hesse, as far as the Netherlands. The port too is constantly filled with ships, but few of them contain any merchandize belonging to the inhabitants of the place.

MENTZEL (Christian), born at Furstenwall in the Mittel-mark, is celebrated for his skill in medicine and botany, in pursuit of which he travelled through many countries. He had correspondents in the most distant parts of the world. He died A. D. 1701, about the 79th year of his age. He was a member of the academy *des Curieux de la Nature*. His works are, 1. *Index nominum plantarum*, printed at Berlin in folio, 1699; and reprinted with additions in 1715, under the title of *Lexicon plantarum polyglotton universale*. 2. A Chronology of China, in German, printed at Berlin, 1696 in 4to. The following manuscripts of his composition are preserved in the royal library at Berlin, 1. *Sur l'Histoire Naturelle du Brasil*, in four volumes folio.

lio. 2. *Sur les Fleurs et les Plantes du Japon*, with coloured plates, two vols folio.

MENUS (anc. geog.), a river of Germany; now the *Maine*, rising in Franconia, and running from east to west into the Rhine at Mentz.

MENUTHIAS (anc. geog.), an island adjoining to the north-east of the promontory Prasum of Ethiopia beyond Egypt. Some take it to be *Madagascar*, or the island of *St Laurence*. Isaac Vossius will have it to be *Zanzibar*; Madagascar being at a greater distance from the continent than the ancients ever failed to, whereas Menuthias was nearer: yet though Zanzibar be nearer the continent, it is however nearer the equator than Ptolemy's Menuthias, placed in south latitude 12½ degrees.

MENYANTHES, Marsh-trefoil, or *Buckbean*: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 21st order, *Preciæ*. The corolla is hairy; the stigma bifid; the capsule unilocular. This plant grows wild in moist marshy places in many parts of Britain. It has three oval leaves standing together upon one pedicle; which issues from the root; their taste is very bitter, and somewhat nauseous. According to Mr Lightfoot, the flowers of this plant are so extremely beautiful, that nothing but their native soil could exclude it from a place in every garden. They grow in an elegant spike; are white, dashed with pink, and fringed internally with hairs. The Highlanders esteem an infusion or tea of the leaves as good to strengthen the stomach. According to Dr Withering, an infusion of the leaves is prescribed in rheumatisms and dropsies; a dram of them in powder purges and vomits, and is sometimes given to destroy worms. In a scarcity of hops, the plant is used in the north of Europe to bitter the ale. The powdered roots are sometimes used in Lapland instead of bread, but they are unpalatable. Some people say, that sheep will eat it, and that it cures them of the rot; but from the Upsal Experiments it appears, that though goats eat it, sheep sometimes will not. Cows, horses, and swine, refuse it.—Dr Lewis informs us, that it is an efficacious aperient and deobstruent; promotes the fluid secretions; and, if liberally taken, gently loosens the belly. It has of late gained great reputation in scorbutic and scrophulous disorders; and its good effects in those cases have been warranted by experience. Inveterate cutaneous diseases have been removed by an infusion of the leaves, drank to the quantity of a pint a-day, at proper intervals, and continued for some weeks. Boerhaave relates, that he was relieved of the gout by drinking the juice mixed with whey.

MENZIKOFF (Alexander), was originally an apprentice to a pastry-cook near the palace of Moscow; but by a fortunate circumstance was drawn from that situation in early life, and placed in the household of Peter the Great. Having made himself master of several languages, and being formed for war and for business, he first rendered himself agreeable, and afterwards became necessary to his master. He assisted Peter in all his projects; and was rewarded for his services with the government of Ingria, the rank of prince, and the title of *major-general*. He signalized himself in Poland in 1708 and 1709; but in 1713 he was accused of embezzling the public money, and fined in 300,000 crowns. The Czar remitted the fine; and having restored him to favour, gave him the command of an army in the Ukraine in 1719, and sent him as his ambassador into Poland in 1722. Constantly employed about the means of preserving his influence after the death of his master, who was then evidently on the decline, Menzikoff discovered the person to whom the Czar intended to leave the succession. The emperor was highly offended, and his penetration cost him the principality of Plescoff. Under the Czarina Katharine, however, he was higher in favour than ever; because, on the death of the Czar in 1725, he was active in bringing different parties in Russia to agree to her succession. This princess was not ungrateful. In appointing her son-in-law Peter II. to be her successor, she commanded him to marry the daughter of Menzikoff, and gave the Czar's sister to his son. The parties were actually betrothed; and Menzikoff was made duke of Cozel and grand-steward to the Czar. But this summit of elevation was the prelude to his fall. The *Dolgoroukis*, favourites of the Czar, had influence enough to procure his banishment, together with that of his family, to one of his own estates at the distance of 250 leagues from Moscow. He had the imprudence to leave the capital with the splendor and magnificence of a governor going to take possession of his province. His enemies took advantage of this circumstance to inflame the indignation of the Czar. At some distance from Moscow he was overtaken by a detachment of soldiers. The officer who commanded them made him alight from his chariot, which he sent back to Moscow; and placed him and his whole family in covered waggons, to be conducted into Siberia, in the habit of peasants. When he arrived at the place of his destination, he was presented with cows and sheep big with young, and poultry, without knowing from whom he received the favour. His house was a simple cottage; and his employment was to cultivate the ground, or to superintend its cultivation. New causes of sorrow were added to the severities of exile. His wife died in the journey; he had the misfortune to lose one of his daughters by the small-pox; and his other two children were seized with the same disease, but recovered. He sunk under his misfortunes, November 2. 1729; and was buried beside his daughter, in a little chapel which he had built. His misfortunes had inspired him with sentiments of devotion, which, amidst the splendor of his former situation, he had altogether neglected. His two surviving children enjoyed greater liberty after the death of their father. The officer permitted them to attend public worship on Sundays by turns. One day when his daughter was returning from the village, she heard herself accosted by a peasant from the window of a cottage, and to her great surprize, recognized in this peasant the persecutor of her family, Dolgorouki; who, in his turn, had fallen a sacrifice to the intrigues of the court. She communicated this intelligence to her brother, who could not behold, without emotion, this new instance of the vanity and instability of honours and power. Young Menzikoff and his sister were soon after recalled to Moscow by the Czarina Ann; and left Dolgorouki in possession of their cottage. He was made

made captain of the guards, and received the fifth part of his father's possessions. His sister was appointed maid of honour to the empress, and afterwards married to great advantage.

MENZINI (Benedict), a celebrated Italian poet, born at Florence, was, professor of eloquence at the college Della Sapienza at Rome, where he died in 1704. He wrote, 1. The art of poetry. 2. Satires, elegies, hymns, and the Lamentations of Jeremiah. 3. *Academia Tusculana*, a work in verse and prose, which passes for his masterpiece.

MEOTIS, or PALUS MEOTIS, a sea of Turky, which divides Europe from Asia; extending from Crim Tartary to the mouth of the river Don or Tanais.

MEPHITIC, a name expressing any kind of noxious vapour; but generally applied to that species of vapour called *fixed air*. See AIR, FIXED *Air*, GAS, &c.

MEPHITIS FANUM, a temple erected to the goddess Mephitis, near Lacus Amsancti; who was worshipped also at Cremona. Figuratively, *Mephitis* denotes a noisome or pestilential exhalation, (Virgil.)

MEQUINEZ, or MIQUINEZ, the northern capital of the Morocco empire, stands at the extremity of the province of Beni-Hassen, 80 leagues north from the city of Morocco (which is the southern imperial city), and 20 to the east of Salee and the ocean. Maknassa, its founder, built it first at the bottom of a valley; but Muley Ismael extended it considerably over the plain that lies to the west of the valley. It is surrounded with well cultivated fields and hills, adorned with gardens and olive plantations, and abundantly watered with rivulets. Accordingly, fruits and kitchen stuffs thrive here exceedingly, and even the superior urbanity of the inhabitants announces the temperature of the climate. The winter indeed is very inconvenient, on account of the dirtiness of the town, the streets not being paved, and the soil being slimy.

Mequinez is surrounded with walls; the palace itself is fortified with two bastions, on which formerly some small guns were mounted. Muley Ismael, and Muley Abdallah, often in this city resisted the efforts of the Brebes, the sworn enemies of their tyranny. To the west are seen some walls of circumvallation, six feet in height, which were probably mere intrenchments for the infantry; the attacks of the Brebes being only sudden and momentary inroads, which did not require a long defence. There is at Mequinez, as well as at Morocco, a walled and guarded suburb for the Jews. The houses are neater here than at Morocco. The Jews here are more numerous; and they can turn their industry to greater account, because the Moors in this city are more polished, and (being nearer Europe) more visited, than those in the southern parts. Near the Jewry, there is another inclosed and separate quarter, called the *Negro-town*. It was built by Muley Ismael, for the accommodation of those black families which composed his soldiery. This town is now uninhabited, as are all those destined for the same use through the rest of the empire.

At the south-east extremity of the city stands the palace of the emperor, which was built by Muley Ismael. The space occupied by this palace is very great; it includes several gardens, elegantly disposed, and well watered. There is a large garden in the centre, surrounded by a vast and pretty regular gallery, resting on columns, which communicates with the apartments. Those of the women are very spacious, and have a communication with a large chamber which looks into the garden. As you pass from one apartment to another, you find at intervals regular courts paved with square pieces of black and white marble; in the middle of these courts is a marble bason, from the centre of which rises a *jet-d'eau*, and the water falls down into this bason. These fountains are numerous in the palace; they are useful for domestic purposes, and they serve for the ablutions, which the scruples of the Mahometans have exceedingly multiplied. The palaces of the Moorish kings are large, because they are composed only of one range of apartments; these are long and narrow, from 18 to 20 feet high; they have few ornaments, and receive the light by two large folding doors, which are opened more or less as occasion requires. The rooms are always lighted from a square court in the centre, which is generally encompassed with a colonade.

The Moors here are more courteous than those in the southern parts; they are civil to strangers, and invite them into their gardens, which are very neat. The women in this part of the empire are beautiful; they have a fair complexion, with fine black eyes, and white teeth. I have sometimes seen them taking the air on the terraces; they do not hide themselves from Europeans, but retire very quickly on the appearance of a Moor.

MERA-DE-ASTA, formerly a large town of Andalusia, seated on the river Guadaleta, between Arcos and Xeres de la Frontera; but now only a large heap of ruins. Here the Arabs conquered Roderick the last king of the Goths, and by that victory became masters of Spain in 713.

MERCATOR (Gerard), one of the most celebrated geographers of his time, was born at Ruremonde in 1512. He applied himself with such industry to geography and mathematics, that he is said to have frequently forgot to eat and drink. The emperor Charles V. had a particular esteem for him, and the duke of Juliers made him his cosmographer. He composed a chronology, some geographical tables, an Atlas, &c. engraving and colouring the maps himself. He died in 1594. His method of laying down charts is still used, and bears the name of *Mercator's charts*.

MERCATOR (Nicholas), an eminent mathematician in the 17th century, was born at Holstein in Denmark; and came to England about the time of the restoration, where he lived many years. He was fellow of the Royal Society; and endeavoured to reduce astrology to rational principles, as appeared from a MS. of his in the possession of William Jones, Esq. He published several works, particularly *Cosmographia*. He gave the quadrature of the hyperbole by an infinite series; which was the first appearance in the learned word of a series of this sort drawn from the particular nature of the curve, and that in a manner very new and abstracted.

MERCATOR's Sailing, that performed by Mercator's chart. See NAVIGATION.

MERCATORUM

Mercatorum, Merchant.

MERCATORUM FESTUM, was a festival kept by the Roman merchants on the 15th of May in honour of Mercury, who presided over merchandise. A sow was sacrificed on the occasion, and the people present sprinkled themselves with water fetched from the fountain called *aqua Mercurii;* the whole concluding with prayers to the god for the prosperity of trade.

MERCHANT, a person who buys and sells commodities in gross, or deals in exchanges; or that traffics in the way of commerce, either by importation or exportation. Formerly every one who was a buyer or seller in the retail way was called a *merchant*, as they still are both in France and Holland; but here shopkeepers, or those who attend fairs or markets, have lost that appellation.

Previous to a person's engaging in a general trade, and becoming an universal dealer, he ought to treasure up such a fund of useful knowledge as will enable him to carry it on with ease to himself, and without risking such losses as great ill-concerted undertakings would naturally expose him to. A merchant should therefore be acquainted with the following parts of commercial learning. 1. He should write properly and correctly. 2. Understand all the rules of arithmetic that have any relation to commerce. 3. Know how to keep books of double and single entry, as journals, a leger, &c, 4. Be expert in the forms of invoices, accounts of sales, policies of insurance, charter-parties, bills of lading, and bills of exchange. 5. Know the agreement between the money, weights, and measures of all parts. 6. If he deals in silk, woollen, linen, or hair manufactures, he ought to know the places where the different sorts of merchandizes are manufactured, in what manner they are made, what are the materials of which they are composed, and from whence they come, the preparations of these materials before working up, and the places to which they are sent after their fabrication. 7. He ought to know the lengths and breadths which silk, woollen, or hair-stuffs, linen, cottons, fustains, &c. ought to have according to the several statutes and regulations of the places where they are manufactured, with their different prices, according to the times and seasons; and if he can add to his knowledge the different dyes and ingredients which form the various colours, it will not be useless. 8. If he confines his trade to that of oils, wines, &c. he ought to inform himself particularly of the appearances of the succeeding crops, in order to regulate his disposing of that he has on hand; and to learn as exactly as he can what they have produced when got in for his direction in making the necessary purchases and engagements. 9. He ought to be acquainted with the sorts of merchandize found more in one country than another, those which are scarce, their different species and qualities, and the propereſt method for bringing them to a good market either by land or sea. 10. To know which are the merchandizes permitted or prohibited, as well on entering as going out of the kingdoms or states were they are made. 11. To be acquainted with the price of exchange, according to the course of different places, and what is the cause of its rise and fall. 12. To know the customs due on importation or exportation of merchandizes, according to the usage, the tariffs, and regulations, of the places to which he trades. 13. To know the best manner of folding up, embaling, or tunning, the merchandizes for their preservation. 14. To understand the price and condition of freighting and insuring ships and merchandize. 15. To be acquainted with the goodness and value of all necessaries for the construction and repairs of shipping, the different manner of their building; what the wood, the masts, cordage, cannons, sails, and all requisites may cost. 16. To know the wages commonly given to the captains, officers, and sailors, and the manner of engaging with them. 17. He ought to understand the foreign languages, or at least as many of them as he can attain to; these may be reduced to four, viz. the Spanish, which is used not only in Spain but on the coast of Africa, from the Canaries to the Cape of Good Hope: the Italian, which is understood on all the coasts of the Mediterranean, and in many parts of the Levant: the German, which is understood in almost all the northern countries; and the French, which is now become almost universally current. 18. He ought to be acquainted with the consular jurisdiction, with the laws, customs, and usages of the different countries he does or may trade to; and in general all the ordinances and regulations both at home and abroad that have any relation to commerce. 19. Though it is not necessary for a merchant to be very learned, it is proper that he should know something of history, particularly that of his own country; geography; hydrography, or the science of navigation; and that he be acquainted with the discoveries of the countries in which trade is established, in what manner it is settled, of the companies formed to support those establishments, and of the colonies they have sent out.

All these branches of knowledge are of great service to a merchant who carries on an extensive commerce; but if his trade and his views are more limited, his learning and knowledge may be so too: but a material requisite for forming a merchant is, his having on all occasions a strict regard to truth, and his avoiding fraud and deceit as corroding cankers that must inevitably destroy his reputation and fortune.

Trade is a thing of so universal a nature, that it is impossible for the laws of Britain, or of any other nation, to determine all the affairs relating to it: therefore all nations, as well as Great Britain, show a particular regard to the law-merchant, which is a law made by the merchants among themselves: however, merchants and other strangers are subject to the laws of the country in which they reside. Foreign merchants are to sell their merchandize at the port where they land, in gross, and not by retail; and they are allowed to be paid in gold or silver bullion, in foreign coin or jewels, which may be exported. If a difference arises between the king and any foreign state, the merchants of that state are allowed six months time to sell their effects and leave the kingdom; during which time they are to remain free and unmolested in their persons and goods. See the articles COMMERCE, and *Mercantile Law*.

Merchet.

MERCHET (MERCHETUM), a fine or composition paid by inferior tenants to the lord, for liberty to dispose of their daughters in marriage. No baron, or military tenant, could marry his sole daughter and heir, without such leave purchased from the king, *pro maritanda*

Mercia. *maritanda filia.* And many of our servile tenants could neither send their sons to school, nor give their daughters in marriage, without express leave from the superior lord. See Kennet's Glossary *in maritagium.* See also MARCHET.

MERCIA, the name of one of the seven kingdoms founded in England by the Saxons. Though the latest formed, it was the largest of them all, and grew by degrees to be by far the most powerful. On the north it was bounded by the Humber and the Mersey, which separated it from the kingdom of Northumberland; on the east by the sea, and the territories of the East-Angles and Saxons; on the south by the river Thames; and on the west by the rivers Severn and Dee. It comprehended well nigh 17 of our modern counties, being equal in size to the province of Languedoc in France; very little, if at all, less than the kingdom of Arragon in Spain; and superior in size to that of Bohemia in Germany.

Penda is regarded as its first monarch; and the kingdom is thought to derive its name from the Saxon word *merc*, which signifies "a march, bound, or limit," because the other kingdoms bordered upon it on every side; and not from the river Mersey, as some would persuade us. Penda assumed the regal title A. D. 626, and was of the age of 50 at the time of his accession; after which he reigned near 30 years. He was of a most furious and turbulent temper, breaking at different times with almost all his neighbours, calling in the Britons to his assistance, and shedding more Saxon blood than had been hitherto spilled in all their intestine quarrels. He killed two kings of Northumberland, three of the East-Angles, and compelled Kenwall king of the West-Saxons to quit his dominions. He was at length slain, with most of the princes of his family, and a multitude of his subjects, in a battle fought not far from Leeds, by Oswy king of Northumberland. This battle, which the Saxon chronicle tells us was fought at Winwidfield, A. D. 655, made a great change in the Saxon affairs, which the unbridled fury of Penda had thrown into great confusion. He had the year before killed Anna king of the East-Angles in battle, whose brother Ethelred notwithstanding took part with Penda. On the other hand, Penda the eldest son of Penda, to whom his father had given the ancient kingdom of the Mid-Angles, had two years before married the natural daughter of King Oswy, and had been baptized at his court. At that time it should seem that Oswy and Penda were upon good terms; but after the latter had conquered the East-Angles, he resolved to turn his arms against the kingdom of Northumberland. Oswy by no means had provoked this rupture; on the contrary, Bede tells us that he offered large sums of money, and jewels of great value, to purchase peace: these offers being rejected, he was reduced to the necessity of deciding the quarrel by the sword. The river near which the battle was fought overflowing, there were more drowned than killed. Amongst these, as the Saxon chronicle says, there were 30 princes of the royal line, some of whom bore the title of *kings*; and also Ethelred king of the East-Angles, who fought on the side of Penda against his family and country.

His son Penda, who married the daughter of that conqueror, became a Christian, and was not long after murdered, as is said, by the malice of his mother. His brother Wolfher becoming king of Mercia, embraced in process of time the faith of the Gospel, and proved a very victorious and potent monarch; and is, with no fewer than seven of his immediate successors, commonly styled *king of the Anglo-Saxons*, though none of them are owned in that quality by the Saxon chronicle. But though possibly none of them might enjoy this honour, they were undoubtedly very puissant princes, maintaining great wars, and obtaining many advantages over the sovereigns of other Saxon states, and especially the East-Angles, whom they reduced. The extent of the Mercian territories was so ample as to admit, and so situated as to require, the constituting subordinate rulers in several provinces; to whom, especially if they were of the royal line, they gave the title of *kings*: which occasions some confusion in their history. Besides the establishing episcopal sees and convents, the Saxon monarchs took other methods for improving and adorning their dominions; and as Mercia was the largest, so these methods were most conspicuous therein. Coventry, as being situated in the centre, was usually, but not always, the royal residence. Penda, who was almost continually in a state of war, lived as his military operations directed, in some great town on the frontiers. Wolfher built a castle or fortified palace for his own residence, which bore his name.—Offa kept his court at Sutton Walls near Hereford.

In each of the provinces there resided a chief magistrate; and if he was of the royal blood, had usually the title of *king*. Penda, at the time he married Oswy's daughter, had the title of *king of Leicester*.—Ethelred made his brother Merowald king of Hereford; who, dying without issue, bequeathed it to his younger brother Mercelm. The like honours were sometimes conferred upon the princesses; and hence, in Mercia especially, we occasionally read of *vice-queens*. By these means the laws were better executed the obedience of the subjects more effectually secured, and the splendor of these residences constantly kept up and augmented.

At length, the crown devolving sometimes on minors and sometimes on weak princes, intestine factions also prevailing, the force of this hitherto mighty kingdom began sensibly to decline. This falling out in the days of Egbert, the most prudent as well as the most potent monarch of the West-Saxons, he took advantage of these circumstances; and having encouraged the East-Angles to make an attempt for the recovery of their independance, he, in a conjuncture every way favourable to his design, broke with the Mercians, and after a short war obliged them to submit. But this was not an absolute conquest, the kings of Mercia being allowed by him and his successors to retain their titles and dominions, till the invasion of the Danes put an end to their rule, when this kingdom had subsisted above 250 years; and when the Danes were afterwards expelled by the West-Saxons, it sunk into a province, or rather was divided into many.

MERCURIAL, something consisting of, or relating to, mercury.

MERCURIALIS (Jerom), an eminent Italian physician

Mercurialis

Mercurialis.

physician, born at Forli in 1530, where he first practised; but afterwards was professor of medicine successively at Padua, Bologna, and Pisa. His writings in physic are very numerous; besides giving an edition of Hippocrates in Greek and Latin, with notes, which, however, did not answer the expectations of the learned. He died in 1606; and in 1644 some select pieces of his were published at Venice in one volume folio.

MERCURIALIS, Mercury, in botany: A genus of the enneandria order, belonging to the diœcia class of plants; and in the natural method ranking under the 38th order, *Tricoccæ*. The calyx of the male is tripartite; there is no corolla, but nine or twelve stamina; the antheræ globular and twin. The female calyx is tripartite; there is no corolla, but two styles; the capsule bicoccous, bilocular, and monospermous. There are three species. 1. The annua, or French mercury, with spiked flowers, male and female. This is an annual plant, with a branching stalk about a foot high, garnished with spear-shaped leaves of a pale or yellowish green colour. The male plants have spikes of herbaceous flowers growing on the top of the stalks: these fall off soon; but the female plants, which have testiculated flowers proceeding from the side of the stalks, are succeeded by seeds, which, if permitted to scatter, will produce plenty of plants of both sexes. 2. The perennis mountain, or dog's mercury, with spiked and testiculated flowers, grows under hedges and in woods in many parts of Britain. This has a perennial root, which creeps in the ground; the stalks are single, and without branches, rising 10 or 12 inches high, garnished with rough leaves, placed by pairs at each joint of a dark green colour, indented on their edges: these have their male flowers growing in spikes, upon different plants from those which produce seeds. 3. The tomentosa, or shrubby hairy mercury, is a native of the south of France, Spain, and Italy. It has a shrubby branching stalk, growing a foot and an half high, garnished with oval leaves placed by pairs, and covered with a white down on both sides. The male flowers grow in short spikes from the side of the stalks upon different plants from the first. All the species are easily propagated by seeds, and are apt to become troublesome weeds where they have once got a footing.

Properties. The perennis, according to Mr Lightfoot, is of a soporific deleterious nature, noxious both to man and beast. There are instances of those who have eaten it by mistake instead of chenopodium, bonus Henricus, or English mercury, and have thereby slept their last. In the isle of Skye, it is called *lusglenbracadale;* and an infusion of it is sometimes taken to bring on a salivation; but our author knows not how the experiment answers. Tournefort informs us, that the French make a syrup of the juice of the annua, two ounces of which is given as a purge; and that they use it in pessaries and clysters, mixing one quantity of honey to one and a half of the juice. Mr Withering differs greatly from Lightfoot concerning the qualities of the perennis. "This plant (says he), dressed like spinach, is very good eating early in the spring, and is frequently gathered for that purpose; but it is said to be hurtful to sheep. Mr Ray relates the case of a man, his wife, and three children, who experienced highly deleterious effects from eating it fried with bacon; but this was probably when the spring was more advanced, and the plant become acrimonious. Steeped in water, it affords a fine deep blue colour. Sheep and goats eat it; cows and horses refuse it.

Mercurification, Mercury.

MERCURIFICATION, in metallurgic chemistry, the obtaining the mercury from metallic minerals in its fluid form. For the effecting this, those who have been engaged in these researches have proposed three methods. The first is by means of a certain mercury, so prepared as to have a dissolving power, by which it could take up the mercuries of metals in the same manner as water dissolves salt from ashes. The second is by means of certain regenerating salts, such as sal ammoniac, which are to detain the more earthy parts of metals, and leave their mercuries separate or separable from them by sublimation or otherwise; and the third method is by means of a large lens or burning-glass, in the focus whereof, if any metal be applied, its mercurial part is said to separate and go off in fume, which when collected and condensed, appears to be running mercury.

The first of these methods would be very easy if the proper mercury were to be readily produced; the second is extremely laborious, and requires much patience and reiteration. But the third seems easy enough, and practicable to advantage, when a glass of three or four feet in diameter is at hand, the sky serene, and the sun shines strong.

For other processes, the reader may consult Junker's Conspectus Chemiæ. But these mercurified metals, or their mercurial principle rendered sensible, are a kind of philosophical mercury, which although they resemble ordinary mercury, are nevertheless said by persons exercised in such studies, to differ from it considerably, by having a greater specific gravity, by more effectually penetrating and dissolving metals, by a stronger adhesion to these, and by a less volatility.

MERCURY, in natural history. See Chemistry-*Index*. See also Metallurgy, and Quicksilver.

The use of mercury in medicine seems to have been little known before the 15th century. The ancients looked upon it as a corrosive poison, tho' of itself perfectly void of acrimony, taste, and smell: there are examples of its having been lodged for years in cavities both in bones and fleshy parts, without its having injured or affected them. Taken into the body in its crude state, and undivided, it passes through the intestines unchanged, and has not been found to produce any considerable effect. It has indeed been recommended in asthmas and disorders of the lungs; but the virtues attributed to it in these cases have not been warranted by experience.

Notwithstanding the mildness and inactivity of crude quicksilver undivided; yet, when resolved by fire into the form of fume or otherwise divided into very minute particles, and prevented from re-uniting by the interposition of proper substances, or combined with mineral acids, it has very powerful effects; affording the most violent poisons, and the most excellent remedies with which we are acquainted.

The mercurial preparations, either given internally or introduced into a habit by external application, seem

Mercury. seem to forward circulation through even the minutest and most remote vessels of the body; and may be so managed as to promote excretion through all the emunctories. Hence their common use in inveterate chronic disorders, and obstinate obstructions of the excretory glands; in scrophulous and cutaneous diseases; and in the venereal lues. If their power be not restrained to certain emunctories, they tend chiefly to affect the mouth; and occasion a plentiful evacuation from the salival glands.

The salutary effects of mercurials do not depend on the quantity of sensible evacuation. This medicine may be gradually introduced into the habit, so as, without occasioning any remarkable discharge, to be productive of very happy effects. To answer this purpose, it should be given in very small doses, in conjunction with such substances as determine its action to the kidneys or the pores of the skin. By this method, inveterate cutaneous and venereal distempers have been cured, without any other sensible excretion than a gentle increase of perspiration or urine. Where there are ulcers in any part, they discharge for some time a very fetid matter, the quantity of which becomes gradually less, and at length the ulcer kindly heals. If the mercury should at any time, from cold, or the like, affect the mouth, it may be restrained by omitting a dose, and by warmth, or suitable medicines promoting the perspiration.

Cooling purgatives are also often employed with advantage; but perhaps the most effectual means of giving with safety a sudden check to a mercurial salivation, is by the application of a large blister to the back.

Mercury, as used in medicine, has been employed in a vast variety of different forms. But there is reason to believe, that every useful purpose to be answered by mercury may be obtained from a very few. The mercurial preparations in general, with a view to their use both externally and internally, may be divided into two great classes, the mild and the acrid. Almost every purpose to be answered by the former, may be accomplished by the unguentum hydrargyri and pilulæ ex hydrargyro of the London and Edinburgh pharmacopœias; while most of the effects to be obtained from the latter may be derived from the proper use of those preparations, hitherto generally known under the title of *calomel*, and *corrosive sublimate mercury*.

The marks of pure mercury are, its globules not losing their spherical figure when poured on wood; its not communicating a tinge to water, or sweetness to vinegar, when rubbed with them; its evaporating entirely in an iron spoon over the fire; and its having a shining appearance without any pellicle on its surface. Mercury is best purified by distillation in an iron pot, with a long neck bent and immersed in vinegar.

Quicksilver has sometimes been used in its pure metallic state, with the view of removing obstructions in the alimentary canal from an idea that it would operate by its weight. But it is seldom attended with a good effect, and sometimes it must do harm.

Whole volumes have been written respecting its operation and use in different diseases, and particularly in venereal affections. Some refer its operation to an evacuant power, others to its operating as a peculiar stimulus, and a third set to its possessing a power of destroying or neutralizing the venereal virus. Of these opinions, the latter is the most generally received, and perhaps the best founded. But for a more full view of the controversy, we may refer our readers to late publications on the venereal disease, and on mercury, by Mr John Hunter, Dr Schwediauer, and Dr Duncan.

In virulent gonorrhœa, it is doubted whether mercury be necessary. This disease is commonly treated like any similar inflammation: and the chief things attended to are cleanliness of the parts, a regular belly, and an abstinence from every thing stimulant in food, drink, &c. An injection of oil with calomel, or white precipitate, is much used, and some prefer a watery solution of opium. The more active injections have sometimes very disagreeable consequences.

When the constitution is affected, which is known by ulcers on the glands, buboes, ulcers in the mouth or throat, copper-coloured spots and ulcers on the surface, nodes, &c. mercury is thrown into the body either by friction or by the mouth. The general rule is, to keep up a slight soreness of the gums for some short time after the symptoms disappear; at the same time it is to be remembered, that mercury sometimes continues gleets, and induces ulcers, that are difficultly distinguished from venereal ones; and that these last only yield to warm bathing, diaphoretic diluents, opiates, country air, and milk diet. Corrosive sublimate is sometimes used, as more speedily arresting disagreeable, spreading, or dangerous ulcers; but the completion of the cure should always be trusted to the mild preparations alone. Mercury is also used in rabies canina, in worms, in hydrocephalus internus, in tetanus, and is by some considered as an antidote to the variolous matter.

Mercury, in the heathen mythology. See Hermes.

Most of the actions and inventions of the Egyptian Mercury have likewise been ascribed to the Grecian, who was said to be the son of Jupiter and Maia, the daughter of Atlas. No one of all the heathen divinities had so many functions allotted to him as this god: he had constant employment both day and night, having been the common minister and messenger of the whole Pantheon; particularly of his father Jupiter, whom he served with indefatigable labour, and sometimes indeed in a capacity of no very honourable kind. Lucian is very pleasant upon the multitude of his avocations; and, according to the confession of the emperor Julian, Mercury was no hero, but rather one who inspired mankind with wit, learning, and the ornamental arts of life, than with courage. The pious emperor, however, omits some of his attributes; for this god was not only the patron of trade, but also of theft and fraud.

Amphion is said, by Pausanias, to have been the first that erected an altar to this god; who, in return, invested him with such extraordinary powers of music (and masonry), as to enable him to fortify the city of Thebes in Bœotia, by the mere sound of his lyre.

Horace gives us the best part of his character.

Thou god of wit, from Atlas sprung,
Who by persuasive pow'r of tongue,

And

And graceful exercise, refin'd
The savage race of human kind,
Hail! winged messenger of Jove,
And all th' immortal powr's above.
Sweet parent of the bending lyre,
Thy praise shall all its sounds inspire.
Artful and cunning to conceal
Whate'er in sportive theft you steal,
When from the god who gilds the pole,
E'en yet a boy, his herds you stole;
With angry voice the threat'ning pow'r
Bade thee thy fraudful prey restore;
But of his quiver too beguil'd,
Pleas'd with the theft, Apollo smil'd.
You were the wealthy Priam's guide,
When safe from Agamemnon's pride,
Through hostile camps, which round him spread
Their watchful fires, his way he sped.
Unspotted spirits you consign
To blissful seats and joys divine;
And, pow'rful, with thy golden wand,
The light, unbodied crowd command;
Thus grateful does thy office prove
To gods below, and gods above. *Francis.*

This ode contains the substance of a very long hymn to Mercury, attributed to Homer. Almost all the ancient poets relate the manner in which the Grecian Mercury discovered the lyre; and tell us that it was an instrument with seven strings; a circumstance which makes it essentially different from that said to have been invented by the Egyptian Mercury, which had but three. However, there have been many claimants besides Mercury to the seven-stringed lyre. See LYRE.

His most magnificent temple was on mount Cylene, in Arcadia. He is described by the poets as a fair beardless youth, with flaxen hair, lively blue eyes, and a smiling countenance. He has wings fixed to his cap and sandals, and holds the caduceus (or staff surrounded with serpents with two wings on the top) in his hand; and is frequently represented with a purse, to show that he was the god of gain. The animals sacred to him, were the dog, the goat, and the cock. In all the sacrifices offered to him, the tongues of the victims were burnt; and those who escaped imminent danger sacrificed to him a calf with milk and honey.

MERCURY, ☿ in astronomy. See ASTRONOMY, *Index*.

This planet is brightest between his elongations and superior conjunction, very near to which last he can generally be seen. He becomes invisible soon after he has found his elongation, going towards his inferior conjunction; and becomes visible again a few days before his next elongation. The brightness of this planet alters sometimes very considerably in 24 hours. It has been observed when less than three degrees distant from the sun, and may, perhaps, sometimes be seen even in conjunction with it.

Mercury and Venus appear brightest and most beautiful in the opposite parts of their orbits: the first, between his elongations and superior conjunction; and the other, between her elongation and inferior conjunction. Therefore, Venus is seen in great perfection as a crescent, particularly in her inferior conjunction, whilst Mercury is seldom seen in such perfect phases. Mercury should be always observed on or near the meridian. When farthest from the sun, he always appears with a very faint light; and when he has a great south declination, or the atmosphere is not perfectly clear, he seldom can be seen in those parts of his orbit, where he only begins to recover his brightness, or where it is much diminished. He has frequently been seen on the meridian even with a small telescope and small power; and it appears from the above statement that he may be obscured in a clear day rather more than half his orbit, or near one hundred and fourscore days in the year.

MERCURY, in heraldry, a term used in blazoning by planets, for the purple colour used in the arms of sovereign princes.

MERCY, a virtue that inspires us with compassion for our brethren, and which inclines us to give them assistance in their necessities. Mercy is also taken for those favours and benefits that we receive either from God or man, particularly in the way of forgiveness of injuries or of debts. Nothing can be more beautiful than the description of mercy given us by Shakespear, in the pleading between Portia and the Jew:

Por. Then must the Jew be merciful.
Shy. On what compulsion must I? tell me that.
Per. The quality of mercy is not strain'd;
It droppeth as the gentle rain from heav'n
Upon the place beneath. It is twice bless'd:
It blesseth him that gives, and him that takes.
'Tis mightiest in the mightiest; it becomes
The throned monarch better than his crown:
The sceptre shows the force of temporal power,
The atribute to awe and majesty,
Wherein doth sit the dread and fear of kings;
But mercy is above this sceptre'd sway,
It is enthroned in the hearts of kings;
It is an attribute of God himself,
And earthly power doth then show likest God's,
When mercy seasons justice. Therefore, Jew,
Though justice be thy plea, consider this,
That in the course of justice none of us
Should see salvation. We do pray for mercy;
And that same prayer doth teach us all to render
The deeds of mercy. *Merchant of Venice*, act iv.

MERCY-SEAT, or PROPITIATORY, in Jewish antiquity, the covering of the ark of the covenant.—The Hebrew name of this cover, which we translate mercy-seat, is *Capporeth* (Exod. xxv. 17. 22.), from *Capper*, which signifies *to cover, to shut up, to expiate, to pay*. This cover was of gold, and at its two ends were fixed the two cherubims of the same metal, which by their wings extended forwards, seemed to form a throne for the majesty of God, who in scripture is represented to us as sitting between the cherubims, and the ark itself was as it were his footstool. It was from hence that God gave his oracles to Moses, or to the high priest that consulted him, (Exod. xxv. 22. Numb. vii. 89.)

MERETRIX, among the Romans, differed from the *prostibula*. The *prostibulæ* were common courtezans, with bills over their doors, signifying their profession, and

Merganser, Mergus.

and were ready at all times to entertain customers; whereas the *meretrices* entertained none but at night. —The *meretrices* differed in their dress from the *matrons*; the former wore the *toga* and short *tunics*, like those of the men: the latter wore the *palla* and the *stola* of such a length as to reach to their feet.

MERGANSER. See MERGUS.

MERGUS, in ornithology, a genus of birds of the order of anseres; distinguished by having the beak of a cylindrical figure, and hooked at the extremities, and its denticulations of a subulated form.

Plate CCXCIV.

1. The cucullatus, or crested diver of Catesby, has a globular crest, white on each side; and the body is brown above and white below. This elegant species inhabits North America. It appears at Hudson's Bay the end of May, and builds close to the lakes.—The nest is composed of grass, lined with feathers from the breast; the number of eggs from four to six. The young are yellow, and are fit to fly in July.—They all depart from thence in autumn. They appear at New York, and other parts as low as Virginia and Corolina, in November, where they frequent fresh-waters. They return to the north in March; and are called at Hudson's Bay *Omiska sheep*.

2. The merganser, or goosander, weighs four pounds: its length is two feet four inches; the breadth three feet. The bill is three inches long, narrow, and finely toothed or serrated; the colour of that and of the irides is red. The *dun-diver*, or female, is less than the male: the head and upper part of the neck is ferruginous; the throat white: the feathers on the hind part are long, and form a pendent crest: the back, the coverts of the wings, and the tail, are of a deep ash-colour: the greater quill-feathers are black, the lesser white; the breast and middle of the belly are white, tinged with yellow. The goosander seems to prefer the more northern situations to those of the south, not being seen in the last except in very severe seasons. It continues the whole year in the Orkneys: and has been shot in the Hebrides in summer. It is common on the continent of Europe and Asia, but most so towards the north. It is found also in Iceland and Greenland, and breeds there, retiring southward in winter, at which time it is found about the lake Baikal. It is frequent in America; inhabits the state of New York in winter; retires from thence in April, probably to Hudson's Bay; and, if it be the bird called a *Fisherman-duck*, found also in Carolina.

3. The serrator, or red-breasted merganser, weighs about two pounds: the length is one foot nine inches, the breadth two feet seven; the bill is three inches, long; the lower mandible red; the upper dusky; the irides a purplish red; head and throat a fine changeable black and green; on the former a long pendent crest of the same colour; the tail short and brown; the legs orange-coloured. The head and upper part of the female are of a deep rush colour, and the tail ash-coloured. These birds are most frequent in the northern parts of Great Britain. They are observed to breed on Loch Mari, in the county of Ross, and in the isle of Islay. The species is common in most parts of the north of Europe, on the continent; and as high as Iceland, where it is called *Vatus-ond*: also in the Russian dominions, about the great rivers of Siberia, and the lake Baikal. It is likewise frequent in Greenland in the summer, where it breeds on the shores. The eggs are like those of a wild duck, but smaller and whiter. It dives well, and is very active in the water; but the Greenlanders often take it by darts thrown at it, especially in August, being the time when it is in moult. It is frequent in Newfoundland, and often appears at Hudson's Bay in large flocks, but is observed to be of a larger size there than in Europe. They generally come in pairs the beginning of June, as soon as the ice breaks up; make the nest soon after their arrival, chiefly on dry spots of ground in the islands, and lay from eight to thirteen white eggs, the size of those of a duck: the nest made of withered grass, and lined with the down of the breast. The young are of a dirty brown, like young goslings. They all depart south in October to the lakes, where they may have open water. They are known at Hudson's Bay by the name of *As-sick*.

Mergus, Merian.

4. The albellus, or smew, weighs about 34 ounces: the length 18 inches, the breadth 26; the bill is near two inches long, and of a lead colour; the head is adorned with a long crest, white above and black beneath: the head, neck, and whole under part of the body, are of a pure white; the tail is of a deep ash-colour, the legs of a bluish grey. The female *lough-diver*, is less than the male: the back, the scapulars, and the tail, are dusky; the belly is white. The smew is seen in England only in winter, at which season it will sometimes be met with at the southern parts of it; as also in France, in the neighbourhood of Picardy, where it is called la Piette: similar to this, we have heard it is called in Kent by the name of *magpye-diver*. On the continent we find it as far south as Carniola; frequents also Iceland, at which place or some other arctic region, it passes the summer; and where it in course breeds, probably along with the other Mergansers; as it has been observed to migrate, in company with those birds, several kinds of ducks, &c. in their course up the Wolga, in February. It also inhabits America, having been sent from New-York, where it is probably a migratory species, as in Europe.

5. The minutus, or redheaded smew, weighs about 15 ounces; the length one foot four inches, the breadth one foot eleven: the bill is of a lead colour: the head slightly crested, and of a rust colour: the hind part of the neck is of a deep grey, the forepart clouded with a lighter colour of the same kind: the back and tail are of a dusky ash-colour, the legs of a pale ash-colour.—It is a native of Europe. Birds of this genus (Mr Latham observes) "are in general not so well-flavoured as those of the duck kind; yet we have often met with the last species in the London markets, and by some they are thought to be very little inferior to the wild duck; which last now and then partakes of the *fishy haut gout*, a flavour not disagreeable to the palates of the connoisseurs in good eating."

MERIAN (MARIA SYBYLLA), a celebrated painteress, born at Francfort in 1647, was the daughter of Matthias Merian, a noted engraver and geographer.—As she showed a very early fondness for painting, she was instructed by Abraham Mignon; from whom she learned great neatness of handling and delicacy of colour,

lour. Her genius particularly led her to paint reptiles, flowers, and insects, which she designed after nature, and studied every object with a most curious and inquisitive observation; so that her works rose every day more and more into reputation. Frequently she painted her subjects in water-colours on vellum, and finished an astonishing number of designs, as she was equally indefatigable in her work and her enquiries into the curiosities of nature. She drew the flies and caterpillars in all the variety of changes and forms in which they successively appear from their quiescent state till they become butterflies; and also drew frogs, toads, serpents, ants, and spiders, after nature, with extraordinary exactness and truth. She even undertook a voyage to Surinam, to paint those insects and reptiles which were peculiar to that climate; and at her return to her own country published two volumes of engravings after her designs, which are well known to the curious. She died in 1717. Her daughter Dorothea Henrietta Graff, who painted in the same style, and had accompanied her mother to Surinam, published a third volume collected from the designs of Sibylla; which complete work has been always admired by the learned, as well as by the professors of painting.

MERIDA, a strong town of Spain, in Estremadura, built by the Romans before the birth of Christ. Here are fine remains of antiquity, particularly a triumphal arch, but not now what it was formerly. It is seated in an extensive and fertile plain, 47 miles east of Elva, and 45 south by east of Alcantara. W. Lon. 6. 4. N. Lat. 38. 42.

MERIDA, a town of North America, in New Spain, and capital of the province of Yutacan, where the bishop and the governor of the province reside. It is inhabited by Spaniards and native Americans; is 30 miles south of the sea, and 120 N. E. of Campeachy. W. Lon. 89. 25. N. Lat. 20. 15.

MERIDA, a town of South America, in the kingdom of New Granada, seated in a country abounding with all kinds of Fruits, 130 miles N. E. of Pampeluna. W. Lon. 71. 0. N. Lat. 8. 30.

MERIDEN, or MIREDEN, a town of Warwickshire, 97 miles from London, in the London road, near Coventry. It is pleasantly situated, though in a wet clayey situation, and is not ill built. The church stands on an elevated spot, and contains some good monuments. There is an inn here, about half way from St Clement's forest to Coventry, one of the finest in this part of Fngland, being built like a nobleman's seat.

MERIDIAN, in geography, a great circle supposed to be drawn through any part on the surface of the earth, and the two poles; and to which the sun is always perpendicular at noon. See GEOGRAPHY.

In astronomy, this circle is supposed to be in the heavens, and exactly perpendicular to the terrestrial one. See ASTRONOMY.

MERIDIANI, in antiquity, a name which the Romans gave to a kind of gladiators who entered the arena about noon after the bestiarii (who fought in the morning against beasts) had finished. They were thus called from *meridies*, i. e. *noon*, the time when they exhibited their shews. The meridiani were a sort of artless combatants, who fought man with man, sword in hand. Hence Seneca takes occasion to observe, that the combats of the morning were full of humanity compared with those which followed.

MERIDIONAL DISTANCE, in navigation, the same with departure, or easting and westing; being the difference of longitude between the meridian, under which the ship now is, and any other meridian which she was under before.

MERIDIONAL parts, miles, or minutes, in navigation, are the parts by which the meridians in a Mercator's chart do increase, as the parallels of latitude decrease.

MERIONETHSHIRE, a county of North-Wales, is bounded on the north by Caernarvonshire and Denbighshire; on the east by Montgomeryshire; on the west by St George's channel, or the Irish sea; and on the south by the river Dyffl, which parts it from Cardiganshire; extending 40 miles in length and 36 in breadth. It is divided into six hundreds, in which are four market-towns, 37 parishes, about 2590 houses, and 17,100 inhabitants. It lies in the diocese of Bangor, and sends one member to parliament. The air is very sharp in winter on account of its many high barren mountains; and the soil is as bad as any in Wales, it being very rocky and mountainous. However, this county feeds large flocks of sheep, many goats, and large herds of horned cattle, which find pretty good pasture in the valleys. Besides these, among their other commodities may be reckoned Welch cotton, deer, fowl, fish, and especially herrings, which are taken on this coast in great plenty.

MERIT, signifies *desert*. This term is more particularly applied to signify the moral goodness of the actions of men, and the rewards to which those actions intitle them.

MERLIN (Ambrose), a famous English poet and reputed prophet, flourished at the end of the 5th century. Many surprising and ridiculous things are related of him. Several English authors have represented him as the son of an incubus, and as transporting from Ireland to England the great stones which form Stonehenge on Salisbury plain. Extravagant prophecies and other works are also attributed to him, on which some authors have written commentaries.

MERLIN, in ornithology. See FALCO.

MERLON, in fortification, is that part of a parapet which is terminated by two embrasures of a battery.

MERLUCIUS, the HAKE, in ichthyology. See GADUS.

MERMAID, or MERMAN, a sea-creature frequently talked of, supposed half human and half a fish.

However naturalists may doubt of the reality of *mermen* or *mermaids*, we have testimony enough to establish it; though, how far these testimonies may be authentic, we cannot take upon us to say. In the year 1187, as Laray informs us, such a monster was fished up in the county of Suffolk, and kept by the governor for six months. It bore so near a conformity with man, that nothing seemed wanting to it but speech. One day it took the opportunity of making its escape; and plunging into the sea, was never more heard of. *Hist. de Angleterre*, P. I. p. 403.

In the year 1430, after a huge tempest, which broke down the dikes in Holland, and made way for the

the sea into the meadows, &c. some girls of the town of Edam in West-Freezeland, going in a boat to milk their cows, perceived a mermaid embarrassed in the mud, with a very little water. They took it into their boat, and brought it with them to Edam, dressed it in womens apparel, and taught it to spin. It fed like one of them, but could never be brought to offer at speech. Some time afterwards it was brought to Haerlem, where it lived for some years, though still showing an inclination to the water. Parival relates, that they had given it some notion of a Deity, and that it made its reverences very devoutly whenever it passed by a crucifix. *Delices de Hollande.*

In the year 1560, near the island of Manar, on the western coast of the island of Ceylon, some fishermen brought up, at one draught of a net, seven mermen and mermaids; of which several Jesuits, and among the rest F. Hen. Henriques and Dimas Bosquez, physicians to the viceroy of Goa, were witnesses. The physician who examined them with a great deal of care, and made dissection thereof, asserts, that all the parts both internal and external were found perfectly conformable to those of men. See the *Hist. de la compagnie de Jesus*, P. II. T. IV. n° 276. where the relation is given at length.

We have another account of a merman, seen near the great rock called the *Diamond*, on the coast of Martinico. The persons who saw it, gave in a precise description of it before a notary. They affirmed that they saw it wipe its hand over its face, and even heard it blow its nose.

Another creature of the same species was caught in the Baltic in the year 1531, and sent as a present to Sigismond king of Poland, with whom it lived three days, and was seen by all the court. Another very young one was taken near Rocca de Sintra, as related by Damian Goes. The king of Portugal and the grand master of the order of St James, are said to have had a suit at law to determine which party these monsters belong to.

In Pontopidan's Natural History of Norway, also, we have accounts of mermaids; but not more remarkable or any way better attested than the above.

MERNS, or KINCARDINSHIRE, a county of Scotland, stretching 27 miles in length and 20 in breadth, is bounded on the east by the German ocean, on the south by the river of North Esk, on the west by Angus, and on the north by the river Dee and Aberdeenshire. The country is pretty plain and level, fruitful in corn and pasturage, producing an infinite number of fir-trees, besides a great number of agreeable plantations; and along the sea-coasts there are many convenient creeks and harbours.—The people are Lowlanders, civil, hospitable, and industrious.—The name *Merns* is by some derived from that of a valiant nobleman, who, subduing the country, received it in reward from Kenneth II. Cambden supposes it to retain part of the ancient name of *Vernicones*. The other name is derived from *Kincardin*, its ancient capital, now an inconsiderable village. The stocking-trade employs the natives from the banks of the Dee to Stone-hive; from thence to the North Esk they are wholly employed in weaving.

MERODACH was an ancient king of Babylon, who was placed among the gods, and worshipped by the Babylonians. Jeremiah (Chap. I. 2.), speaking of the ruin of Babylon, says, "Babylon is taken, Bel is confounded, Merodach is broken in pieces, her idols are confounded, her images are broken in pieces." We find certain kings of Babylon, in whose names that of Merodach is contained: for example, Evilmerodach and Merodach-baladan. Evilmerodach was the son of Nebuchadnezzar the Great, and had for his successor the wicked Belshazzar. Merodach-baladan, son of Baladan king of Babylon, having heard that Hezekiah had been cured miraculously (Isa. xxxix.), and that the sun had gone backwards to give him an assurance of his recovery, sent him presents, and made him compliments upon the recovery of his health. Ptolemy calls him *Mardocempadus*; and says, that he began to reign at Babylon 26 years after the beginning of the era of Nabonassar, that is, in the year of the world 2283.

MEROE (anc. geog.), an Island of Ethiopia beyond Egypt, in the Nile; with a cognominal town, the metropolis of the Ethiopians.

The Jesuits have endeavoured to prove, that the province of Gojam in Abyssinia is the Meroë of the ancients; but this is strongly contested by Mr Bruce, who is of opinion that it must be looked for somewhere between the source of the Nile and its union with the Atbara. The latter, he thinks, is very plainly the Astaboras of the ancients; and Pliny says that this stream incloses the left side of Meroë as the Nile does the right, in which case we must suppose him looking southward from Alexandria, otherwise the words would not apply.

We are told by Diodorus Siculus, that Meroë had its name from a sister of Cambyses king of Persia, who died there in the expedition undertaken by that prince against the Ethiopians. His army perished with hunger and thirst in the deserts beyond Meroë; which could not have happened if they had reached Gojam, the latter being one of the most plentiful countries in the world. A further proof that Gojam cannot be the ancient Meroë is, that the latter was inclosed between the rivers Nile and Astaboras, while Gojam is almost entirely surrounded by the Nile. If the ancients were acquainted with Gojam, they must also have been acquainted with the fountains of the Nile, which we certainly know they were not. Pliny says that Meroë, the most considerable of all the islands of the Nile, was called *Astaboras*, from the name of its left channel, which cannot be supposed any other than the junction of the Nile and Atbara. He informs us moreover, that the sun was vertical twice in the year, *viz.* when proceeding northward he entered the 18th degree of Taurus, and when returning he came to the 14th degree of Leo; but this could never be the case with Gojam, which lies in about 10 degrees north latitude.

Again, the poet Lucan describes Meroë by two circumstances which cannot apply to any other than the peninsula of Atbara. One is, that the inhabitants were black; which was the case with the Gymnosophists and first inhabitants, and which has been the case with all the rest down to the Saracen conquest: but the inhabitants of Gojam, as well as the other Abyssinians, are fair, at least greatly different in complexion from the blacks; they are also long haired, and

Meroe, Merom.

and nobody imagined that they ever had philosophers or science among them, which was eminently the case with the ancient inhabitants of Meroë. The other circumstance is, that the ebony tree grew in the island of Meroë, which at this day grows plentifully in the peninsula of Atbara, and part of the province of Kuara, but not in Gojam, where the trees could not subsist on account of the violent rains which take place during six months of the year. Mr Bruce mentions another circumstance quoted from the poet Lucan, which likewise tends to prove the identity of Meroë and Atbara,: viz. that though there are many trees in it, they afford no shade. This our traveller found by experience, when returning from Abyssinia through Atbara; "The country (says he) is flat, and has very little water. The forest, though thick, afforded no sort of shade, the hunters for the sake of their sport, and the Arabs for destroying the flies having set fire to all the dry grass and shrubs; which passing with great rapidity in the direction of the wood from east to west, though it had not time to destroy the trees, did yet wither, and occasion every leaf that was upon them to fall, unless in those spaces where villages had been and where water was. In such spots a number of large spreading trees remained full of foliage; which from their great height and being cleared of underwood, continued in full verdure, loaded with large, projecting, and exuberant branches. But even here the pleasure that their shade afforded was very temporary, so as to allow us no time for enjoyment. The sun, so near the zenith, changed his azimuth so rapidly, that every few minutes I was obliged to change the carpet on which I lay, round the trunk of the tree to which I had fled for shelter: and though I lay down to sleep perfectly screened by the trunk or branches, I was presently awakened by the violent rays of a scorching sun, the shade having passed beyond me. In all other places, though we had travelled constantly in a forest, we never met with a tree that could shade us for a moment, the fire having deprived them of all their leaves." The heat of Atbara is excessive, the thermometer having been observed at 119 ½°: two of Mr Bruce's company died of thirst, or at least of the consequences of drinking after extreme thirst. The inhabitants live in the greatest misery, and are continually in danger from the neighbouring Arabs, who, by destroying and burning their corn, are able to reduce them to a starving condition. Notwithstanding all their disadvantages, however, they have a manufacture of course cotton towels, of a size just sufficient to go round the waist, which pass current as silver money throughout the whole country.

MEROM, (anc. geog.) The waters of Merom at which place Jabin and the other confederate kings met to fight Joshua (xi, 5.),, are generally supposed by the learned to be the lake Semechon, which lies between the head of the river Jordan and the lake Gennesareth; since it is agreed on all hands, that the city Hazor, where Jabin reigned, was situated upon this lake. But others think, that the waters of Merom or Merome were somewhere about the brook Kishon, since there is a place of that name mentioned in the account of the battle against Sisera (Judg. v. 21.) And it is more rational to think, that the confederate kings advanced as far as the brook Kishon, and to a pass which led into the country, to hinder Joshua from penetrating it, or even to attack him in the country where he himself lay encamped, than to imagine that they waited for him in the midst of their own country; leaving all Gallilee at his mercy, and the whole tract from the brook Kishon to the lake Semechon.

Merope, Merops.

MEROPE (fab. hist.) one of the Atlantides. She married Sisyphus the son of Æolus, and like her sisters was changed into a constellation after death. It is said that in the constellation of the Pleiades the star of Merope appears more dim and obscure than the rest, because she, as the poets observe, married a mortal, while her sisters married some of the gods or their descendants.

MEROPS (fab. hist.) a king of the island of Cos, who married Clymene, one of the Oceanides. He was changed into an eagle, and placed among the constellations. Also a celebrated soothsayer of Percosus in Troas, who foretold the death of his sons Adrastus and Amphius, who were engaged in the Trojan war. They slighted their father's advice, and were killed by Diomedes.

MEROPS, in ornithology, a genus belonging to the order of picæ. The bill is crooked, flat, and carinated; the tongue is jagged at the point; and the feet are of the walking kind. 1. The apiaster, or bee-eater, has an iron-coloured back; the belly and tail are of a bluish green; and the throat is yellow. This bird inhabits various parts of Europe, on the continent, though not in England; yet is said to have been seen in Sweden, and flocks of them have been met, with at Anspach in Germany in the month of June. They are now and then seen in Lorraine, though only in pairs; and are not unfrequent in other parts since Kramer talks of their building the nest in the sandy crags of the Danube. They are met with in Italy and the south of France; and in Candia and other islands of the Mediterranean, they are in plenty, as well as in Palestine and Arabia, being very common in the woods about Yemen, where they are called Schæghagha. It takes the name of *bee-eater* from its being very fond of those insects; but, besides these, it will catch gnats, flies, cicadæ, and other insects, on the wing, like the swallow. Willoughby tells us, from Belon, "that its singular elegancy invites the Candy boys to hunt for it with cicadæ, as they do for those greater swallows called *swifts* after this manner:—Bending a pin like a hook, and tying it by the head to the end of a thread, they thrust it through a cicada (as boys bait a hook with a fly), holding the other end of the thread in their hands: the cicada, so fastened, flies nevertheless in the air; which the Merops spying, flies after it with all her force; and catching it, swallows pin and all, wherewith she is caught."—This bird is said to be in most plenty in the isle of Candia; and, in defect of insects, to eat seeds of many kinds; and Ray supposes, from its similarity to the kingsfisher, it may possibly feed on fish. Most probably some think it good to eat, as Willoughby saw many of them exposed for sale in the markets of Rome. These birds make their nests in deep holes in the banks of rivers, like the sand martin and kingsfisher, at the end of which the female lays from five to seven white eggs, rather less than those of

of a blackbird. The neſt itſelf is compoſed of moſs. 2. The virides, or Indian bee-eater, is green, with a black belt, on the breaſt; and the throat and tail are black. It inhabits Bengal. 3. The congener is yellowiſh, with a green rump. It inhabits the ſouth of Europe. 4. The ſuperciliosus is green, with a white line both above and below the eyes, and a yellow throat. It is found in Madagaſcar, where the natives give it the name of *Patirich Tirich*. 5. The cinereus is variegated with red and yellow, with the two longeſt quill-feathers of the tail red. It is a native of Mexico. 6. The erythropterus, or red-winged bee-eater, is in length ſix inches; the bill is one inch, and black: the upper parts of the head, body, wings, and tail coverts, are green brown, deepeſt on the head and back, lighteſt on the rump and tail coverts; behind the eye is a ſpot of the ſame, but of a very deep colour: the quills and tail are red, tipped with black; the laſt two inches in length: the throat is yellow; the under parts of the body are a dirty white; and the legs black.—This inhabits Senegal, from which place a well-preſerved ſkin was brought by M. Adanſon. (See fig. A.) 7. The wattled bee-eater (fig. B.) is the ſize of a cuckow, in length about 14½ inches. The feathers on the upper part of the head, being longer than the reſt, give the appearance of a creſt; thoſe of the under part are ſmooth; the plumage for the moſt part is brown; the feathers are long and pointed and each feather has a ſtreak of white down the middle; under the eye, on each ſide, is a kind of wattle, of an orange colour; the middle of the belly is yellow; the tail is wedge-ſhaped, ſimilar to that of the magpie, and the feathers are tipped with white; the bill and legs are brown.—This bird is ſuppoſed to be peculiar to New Holland. There are 14 or 15 other ſpecies.

Plate CCXCIV.

MEROVINGIAN CHARACTER, derives its name from Meroüée, the firſt king of France of that race, which reigned 333 years, from Pharamond to Charles Martel. This race is ſaid by ſome to have terminated in Childeric III. A. D. 751. There are many MSS. in the French libraries ſtill extant in this character.

MEROZ, (anc. geog.), a place in the neighbourhood of the brook Kiſſion, whoſe inhabitants refuſing to come to the aſſiſtance of their brethern when they fought with Siſera, were put under an anathema (Judge, v. 23.) "Curſe ye Meroz, ſays the angel of the Lord; curſe ye bitterly the inhabitants thereof: becauſe, &c." Some have thought that Meroz is the ſame as Merrus or Merom; and this F. Calmet thinks the moſt probable opinion in this matter. Others will have it, that Meroz was a mighty man, who dwelt near the Kiſhon and not caring to come, to the aſſiſtance of Barak and Deborah, was excommunicated by the angel of the Lord by the ſound of 400 trumpets. The angel of the Lord, according to ſome, was Barak, the general of the Lord's army: but according to others he was the high-prieſt for the time being, or a prophet.

MERSA, a town of Barbary, pleaſantly ſituated about 11 miles from the city of Tunis, and two from Melcha the ſite of ancient Carthage. The Bey has here two country-houſes, one of them very coſtly work, built by Haſſan Bey ſurnamed the *Good*. From theſe are orange gardens reaching almoſt to the ſea-ſhore; on the edge of which is a famous well of ſweet water, eſteemed the beſt and lighteſt in the kingdom. Cloſe to this is a coffee-houſe, whither numbers of people from the neighbouring places reſort to drink coffee, and a glaſs of this natural luxury ſo peculiarly enjoyed in the eaſtern countries. In the middle of the court is a large mulberry tree, under the ſhade of which they ſit and ſmoke and play at cheſs; inhaling the comfortable ſea breeze that refreſhes this delightful ſpot. The water is drawn up by a camel with the Perſian wheel.

Here are the remains of an ancient port, or cothou, (ſuppoſed to be an artificial one), built by the Carthaginians after Sapii had blocked up the old port, nothing but the turret or light-houſe being left.

MERS or MERSE, a county of Scotland, called alſo *Berwickſhire*. This laſt name it derives from the town of Berwick, which was the head of the ſhire before it fell into the hands of the Engliſh, and obtained the appellation of *Mers* or *March*, becauſe it was one of the borders towards England. It is waſhed on the ſouth and eaſt by the river Tweed and the German Ocean, bounded on the weſt by Tweedale, and on the north by Lothian. It extends 24 miles from eaſt to weſt, and the breadth amounts to 16. The face of the country is rough and irregular, exhibiting hills, moors, and moſſes, with intermediate valleys, which are pleaſant and fruitful. It is watered by many ſtreams; and particularly by the famous Tweed, which riſing from the ſame hills that give birth to the Clyde and Annan, runs with a rapid courſe though Tweedale foreſt and Teviotdale, and after a courſe of 50 miles diſembogues itſelf into the German Ocean. Notwithſtanding the length of its courſe, it is not navigable above Berwick, where there is a noble bridge over it, conſiſting of 15 arches. There is another fine one, called the *Union Bridge*, at Coldſtream. There is a third at Melroſe, a fourth at Peebles, and a fifth at Kelſo. The ſhire of Berwick is generally diſtinguiſhed into the three diviſions of Mers, Lammermuir, and Lauderdale. The Mers is low, pleaſant, and tolerably fruitful in corn. Lammermuir is a hilly country, abounding with game, and yielding good paſture for ſheep and black cattle. Lauderdale is a tract of land lying on each ſide of the river Lauder, agreeably varied with hill, dale, and foreſt, producing good ſtore of corn and paſturage, and giving the title of earl to the family of Maitland: but the moſt fruitful and populous parts of Berwickſhire, are thoſe that lie along the Tweed, and on both ſides of the leſſer rivers White Water, Black Water, and Eye. The ſeats of noblemen and gentlemen abound in this country.

MERSENE (Marin), in Latin *Merſennus*, a learned French author, born at Oyſe, in the province of Maine, anno 1588. He ſtudied at La Fleche at the ſame time with Des Cartes; with whom he contracted a ſtrict friendſhip, which laſted till death. He afterwards went to Paris, and ſtudied at the Sorbonne; and in 1611 entered himſelf among the minims. He became well ſkilled in Hebrew, philoſophy, and mathematics. He was of a tranquil, ſincere, and engaging temper; and was univerſally eſteemed by perſons illuſtrious for their birth, their dignity, and their learning.

Mersey || Merus.

learning. He taught philosophy and divinity in the convent of Nevers, and at length became superior of that convent; but being willing to apply himself to study with more freedom, he resigned all the posts he enjoyed in his order, and travelled into Germany, Italy, and the Netherlands. He wrote a great number of excellent works: the principal of which are, 1. *Quæstiones celeberrimæ in Genesim.* 2. *Harmonicorum libri.* 3. *De sonorum natura, causis, & effectibus.* 4. *Cogita physico-mathematica.* 5. *La verite des Sciences.* 6. *Les questions inouies.* He died at Paris in 1648. He had the reputation of being one of the best men of his age. No person was more curious in penetrating into the secrets of nature, and carrying all the arts and sciences to their utmost perfection. He was in a manner the centre of all the men of learning, by the mutual correspondence which he managed between them. He omitted no means to engage them to publish their works; and the world is obliged to him for several excellent discoveries, which, had it not been for him, would perhaps have been lost.

MERSEY, a river of England, that runs through the counties of Lancaster, York, and Chester, and empties itself into the Irish sea at Liverpool. By the late inland navigation, it has communication with the rivers Dee, Ribble, Ouse, Trent, Darwent, Severn, Humber, Thames, Avon, &c.; which navigation, including its windings, extends above 500 miles, in the counties of Lincoln, Nottingham, York, Lancaster, Westmoreland, Chester, Stafford, Warwick, Leicester, Oxford, Worcester, &c.

Merser-Island, an island of Essex, at the mouth of the Coln, south of Colchester. It was seized by the Danes in the reign of King Alfred, for their winter-quarters. It had eight parishes, now reduced to two, viz. east and west Mersey. The island had a block-house; and, in the Dutch war, the parliament put 1000 men in it.

MERULA (George), an Italian of extraordinary parts and learning, born at Alexandria in the duchy of Milan about the year 1420. He taught youth at Venice and Milan for 40 years, and laboured abundantly in restoring and correcting ancient authors. He wrote, and addressed to Lewis Sforza, *Antiquitates Vicecomitum*; or "The Actions of the Dukes of Milan," in 10 books; with some other things in the same way. His death, in 1494, is said not to have grieved any body; as he lived in a state of war with, and abused, almost all his cotemporary scholars.

MERULA (Paul), born at Dort in Holland, a famous lawyer, historian, and linguist, was professor of history in the university of Leyden after Lipsius. He wrote, 1. Commentaries on Ennius; 2. The life of Erasmus and Junius; 3. A cosmography; 4. A treatise of law; and died in 1607.

Merula, or *Blackbird*, in ornithology. See Turdus.

MERUS, (anc. geog.), a mountain of the Hither India, hanging over the city Nyssa, built by Bacchus, and situated between the rivers Cophen and Indus. The name, denoting the *thigh*, gave rise to the fable of Bacchus being inserted into Jupiter's thigh, and being born twice; because in this mountain he and his army are said to have been preserved, when disease and pestilence raged in the place below.

Mesaraic || Mesentery.

MESARAIC-vessels, in the general sense, are the same with Mesenteric.

In common use, mesaraic is more frequently applied to the veins, and mesenteric to the arteries, of the mesentery. See Anatomy.

MESCHED, a considerable town of Persia, and in the province of Khorassan; fortified with several towers, and famous for the magnificent sepulchre of Iman Risa, of the family of Ali, to whom the Persians pay great devotion. It is seated on a mountain near this town, in which are fine torquoise-stones; in E. Long. 59. 25. N. Lat. 37. 0.

MESEMBRYANTHEMUM, Fig-marigold, in botany: A genus of the pentagynia order, belonging to the icosandria class of plants; and in the natural method ranking under the 13th order, *Succulentæ*, The calyx is quinquefid; the petals are numerous and linear; the capsule is fleshy, inferior, and monospermous. There are between 40 and 50 species; all African plants, from the Cape of Good Hope; near 40 of which are retained in our gardens for variety. Of these only one is annual, and the most remarkable of them all. It is called the *crystallinum*, *diamond ficoides*, or *ice-plant*. It rises with a short, thick, succulent stalk, dividing low into many trailing, very spreading, succulent branches, bespangled all over with icy pimples; very pellucid and glittering; oval, undulate, alternate, papulose or pimply, glittering leaves; and from the sides of the branches, numerous, almost close sitting, white flowers, tinged with red or crimson; succeeded by plenty of seed in autumn. This singular and curious plant, being closely covered with large pellucid pimples, full of moisture shining brilliantly like diamonds, is in great esteem. It is a very tender plant while young; and is raised annually from seed by means of hot-beds. In June it will endure the open air till October, when it perishes; but if placed in a hot-house in autumn, it will often live all winter. It is commonly planted in pots for the conveniency of removing from place to place: but if planted in the full ground, it grows considerably stronger, even to luxuriance: however, when confined in pots, it flowers more abundantly.

The other species are most durable in stem and foliage. Some are shrubby; others pendulous, with loose straggling stems, and branches inclining to the ground; while others have no stalks at all; their leaves are universally very thick, succulent, fleshy; and of many various shapes, situations; and directions while some are curiously punctured, or dotted with transparent points, and some have pellucid pimples, as already mentioned: they afford a very agreeable variety at all times in the year, and merit a place in every collection They are green-house plants, and are propagated by cuttings of their stalks and branches.

MESENTERIC, or Mesaraic an epithet given to two arteries arising from the descending aorta, and proceeding to the mesentery. See Mesentery.

MESENTERITIS, or *inflammation of he* Mesentery. See Medicine, n° 191.

MESENTERY, Mesenterium, (formed of μεσ@. middle,

middle, and ἐντερον *intestine)*, in anatomy, a fatty membranous body, thus called as being placed in the middle of the intestines, which it connects to one another. See ANATOMY, n° 94.

MESHES *of* NETS, the openings or interstices between the threads.

MESN, or MESNE, a term in law, signifying him who is lord of a manor, and so hath tenants holding of him; yet he himself holds of a superior lord.

The word is properly derived from *maisne, quasi minor natu;* because his tenure is derived from another, from whom he holds.

MESN also denotes a writ, which lieth where there is lord mesn and tenant; and the tenant is distrained for services due from the mesn to the superior lord.

This is in the nature of a writ of right; and in this case the tenant shall have judgment to be acquitted or indemnified by the mesne lord; and if he makes default therein, or does not appear originally to the tenant's writ, he shall be forejudged of his mesnalty, and the tenant shall hold immediately of the lord paramount himself.

MESOCHRI, were musicians among the ancients who presided in concerts, and by beating a wooden desk regularly with their feet, directed the measure of the music. For the purpose of beating time, they wore wooden clogs, called by the ancients *crupezia;* which occasioned the sound to be better heard.

MESOCOLON, in anatomy, that part of the mesentery, which, having reached the extremity of the ileum, contracts and changes its name. See ANATOMY, n° 94.

MESOLOGARITHMS, according to Kepler are the logarithms of the co-sines and co-tangents; the former of which were called by Baron Napier *anti-logarithms*, and the latter *differentials*.

MESOPOTAMIA, the ancient name of the province of DIARBECK, in Turky in Asia. It is situated between the rivers Euphrates and Tigirs; having Assyria on the east, Armenia on the north, Syria on the west, and Arabia Deserta with Babylonia on the south. The Hebrews called it *Padan-aram* (Gen. xxviii. 2. &c.), and *Aram Naharaim* (title of Psal. lx.) or Aram *of the two rivers*, because it was first peopled by Aram father of the Syrians, and is situated between the two rivers already mentioned. This country is much celebrated in scripture, as being the first dwelling of men both before and after the deluge; and because it gave birth to Phaleg, Heber, Terah, Abraham, Nahor, Sarah, Rebekah, Rachel, Leah, and to the sons of Jacob. Babylon was in the ancient Mesopotamia, till, by vast labour and industry, the two rivers of the Tigris and Euphrates were united into one channel. The plains of Shinar were in the same country. Often they gave it the name of Mesopotamia (Deut. xxiii. 4. &c.), and sometimes that of Syria, (Hosea xii. 12.). Balaam son of Beor was of Mesopotamia, Deut, xxiii. 4. Chushan-rishathaim king of Mesopotamia kept the Hebrews in subjection some time after the death of Joshua, Judg. iii. 8.

MESOPTERYGIUS, in ichthyology, a term applied to such fishes as have only one back-fin, and that situated in the middle of the back.

MESPILUS, the MEDLAR, in botany: A genus of the pentagynia order, belonging the icosandria class of plants; and in the natural method ranking under the 36th order, *pomaceæ*. The calyx is quinquefid; the petals are five; the berry is inferior and pentaspermous. There are seven species, viz,

1. The Germanica, German mespilus, or common medlar, rises with a deformed tree-stem, branching irregularly 15 or 20 feet high spear-shaped leaves, downy underneath; and large close sitting, white flowers, singly from the sides of the branches; succeeded by large roundish brown fruit, the size of middling apples, which ripen in October, but are not eatable till beginning to decay. The varieties are, common great German medlar—smaller Nottingham medlar—spear-shaped Italian medlar. This species and varieties are all cultivated in the English gardens for the fruit: but the German or Dutch medlar, and the Nottingham kind, are the most common; and the latter of which two, though a smaller fruit, is rather preferable for richness and poignancy of flavour. These kinds of fruit are never eatable until they begin to rot; for when firm and sound, they are of a singularly austere disagreeable taste; yet having lain some time after being gathered, till they begin to assume a state of decay and became soft, they acquire a delicious flavour, extremely agreeable to many, though to others altogether unpalatable.—All these sorts ripen in the latter end of October, or beginning of November; when being gathered, some should be laid in moist bran, in several layers, to forward their decay; others on straw in the fruitery: those in the bran will begin to be ready for use in about a fortnight, and those laid on straw will come gradually forward in succession.

2. The arbutifolia, arbutus-leaved mespilus, hath a shrubby stem, branching erectly five or six feet high; lanceolate, crenated, alternate leaves, downy underneath; and from the sides and ends of the branches, small white flowers in clusters; succeeded by small, roundish, purple fruit, like haws.

3. The amelanchier, or shrubby, medlar, with black fruit, rises with several shrubby, slender, hairy stems, branching moderately about four feet high, having purplish branches; oval, serrated leaves, downy underneath; and small white flowers, in clusters at the ends of the branches: succeeded by small black fruit.

4. The chamæ-mespilus, or dwarf medlar, commonly called *bastard quince*, hath a shrubby, slender smooth stem, branching weakly four or five feet high having purplish branches; oval, serrated, smooth leaves, on long foot-stalks; and from the axillas, purple flowers, collected into round heads, with narrow, purplish, deciduous bracteæ; succeeded by small red fruit.

5. The cotoneaster, commonly called *dwarf quince*, rises with a shrubby, smooth stem, branching four or five feet high, the branches slender and reddish; oval entire leaves on short foot-stalks; and from the axillas, small close-sitting purple flowers, two or three together succeeded by small roundish, bright-red fruit.

6. The Canadensis, Canada snowy mespilus, hath a shrubby, smooth stem, branching four or five feet high, with smooth, purplish branches; oval-oblong, serrated, smooth leaves, on long footstalks; and all the

the branches terminated by clusters of snowy-white flowers; succeeded by small, purplish fruit, like haws.

7. The pyracantha, or ever-green thorn, rises with a shrubby, spinous stem, branching diffusely 12 or 14 feet high, the branches slender and flexible, with a dark greenish bark, armed with long sharp spines; spear-shaped-oval, crenated, ever-green leaves: and all the shoots terminated by numerous clusters of whitish flowers; succeeded by large bunches of beautiful red berries, remaining all winter, and exhibiting a very ornamental appearance.

All these seven species of mespilus are of the tree and shrub kind: the first six sorts are deciduous, the seventh an ever-green; the leaves are universally simple; those of the mespilus Germanica very large, the others mostly of moderate size, and which in most of the sorts grow upon short footstalks. They all flower abundantly every summer, the flowers universally hermaphrodite, and consisting each of five large roundish petals, 20 stamina, and five styles. They are all very hardy, and succeed in any common soil and situation, and their propagation and culture is very easy.

The first sort and varieties are cultivated as fruit-trees, principally as standards, sometimes also as espaliers for variety. The other species are very proper furniture for any ornamental plantation, where they will make an agreeable variety with their different foliage; and their flowers make a fine appearance, as also their fruit in autumn and winter, which, if not devoured by birds, remain long on the branches, and afford a fine variety in those seasons. The pyracantha, being rather of flexible growth, is most commonly trained against walls or the fronts of houses, both for the support of its flexible branches, and that it may exhibit its berries more ornamentally.

When it is designed to have any of the common medlars as fruit-trees, they may be trained either as dwarfs, for dwarf standards, or for espaliers, or trained as half or full standards, and managed in either of those modes of training nearly as other fruit-trees, particularly the apple and pear; and are raised either by seed, by grafting, or by budding; but either of the two latter methods are the most certain for continuing the sorts without variation: observing, after shortening their first shoots from the graft or bud, where it shall seem necessary to force out a proper supply of wood to form a head, to train the branches afterwards principally at full length, and let the standards branch out in their own way.

MESS, in a military sense, implies a number of soldiers, who, by laying away a certain proportion of their pay towards provisions, mess together: six or eight is generally the number of each mess. Experience proves, that nothing contributes more to the health of a soldier, than a regular and well-chosen diet, and his being obliged every day to boil the pot: it corrects drunkenness; and in a great measure prevents gaming, and thereby desertion.

MESSALINA (Valeria), a daughter of Messala Barbatus. She married the emperor Claudius, and disgraced herself by her cruelties and incontinence. Her husband's palace was not the only seat of her lasciviousness, but she prostituted herself in the public streets, and few men that were at Rome who could not boast of having enjoyed the favours of the impure Messalina. Her extravagancies at last irritated her husband, who commanded her to appear and answer all the accusations which were brought against her: upon which she attempted to destroy herself; and when her courage failed, one of the tribunes who had been sent to her dispatched her with his sword. It is in speaking of her debaucheries and lewdness that Juvenal says,

Et lassata virus, nondum satiata, recessit.

Her name has become a common appellation to denote a woman of shameless and inordinate lust.

MESSANA, (anc. geog.), the first town of Sicily on crossing over from Italy, situated on the strait now called the *Faro*, (Italicus). Anciently called *Zancle*, according to Diodorus Siculus, from king Zanclus; or, according to others, from the Sicilian term *Zanclon*, denoting a sickle, alluding to the curvity of the coast: a name appropriated by the poets; and hence *Zanclæi*, the people, (Herodotus, Pausanias). The other name *Messani* is from the *Messenii* of Peloponnesus, (Strabo). Thucydides ascribes its origin to Anaxilas the Messenian, tyrant of Rhegium, who received all comers, calling the town after the name of his country. The Greeks always call it *Messene*; the Romans *Messena* constantly, to distinguish it from *Messene* of Peloponnesus. Now MESSINA, lately ruined by earthquakes.

MESSENA, or MESSENE, an inland town, and the capital of Messenia, a country of Peloponnesus; erroneously placed by Ptolemy on the coast. It was built by Epaminondas, who recalled all the Messenian exiles, and gave the town the name of *Messene*. A place vying in point of strength and situation with Corinth, according to Strabo; and therefore Demetrius Phalerius advised Philip, father of Perseus, that if he wanted to have Peloponnesus in his power, he should make himself master of these two towns, as thus he would have the ox by both horns.

MESSENGERS, are certain officers chiefly employed under the direction of the secretaries of state, and always in readiness to be sent with all kinds of dispatches foreign and domestic. They also, by virtue of the secretaries warrants, take up persons for high treason, or other offences against the state. The prisoners they apprehend are usually kept at their own house, for each of which they are allowed 6s. 8d. *per* day by the government: and when they are sent abroad, they have a stated allowance for ther journey, viz. 30l. for going to Paris, Edinburgh, or Dublin; 25l. for going to Holland; and to other places in the same proportion; part of which money is advanced for the expence of their journey. Their standing salary is 45 l. *per annum*; and their posts if purchased, are esteemed worth 300 l. The messengers wait 20 at a time, monthly, and are distributed as follows, viz. four at court, five at one secretary's office, five at another, two at the third for North Britain, three at the council-office, and one at the lord chamberlain's of the household.

MESSENGERS, in Scotland. See LAW, Part III. p. 651, par. 16.

MESSENGERS of the Exchequer, are four officers who attend the exchequer, in the nature of pursuivants and carry the lord treasurer's letters, precepts, &c.

MESSENGER of the Press, a person who, by order-

of the court, searches printing-houses, booksellers shops, &c. in order to discover the printers or publishers of seditious books, pamphlets, &c.

MESSENIA, a country in the south of Peloponnesus, mostly maritime, situated between Elea to the west, and Laconica to the east. Anciently a part of Laconica under Menelaus, and called *Messene* by Homer; interpreted by the scholiast, *Messenæa Regia*. *Messinii*, the people reduced to a state of slavery and subjection by the Spartans; *Messenius*, the epithet.

This country is famous in history, on account of the resistance made by the Messenians against the Spartans, and the exploits of their hero Aristomenes. The first hostilities commenced about the year 652 B. C. on what occasion is uncertain. Though the Messinians were inferior in the knowledge of the art of war to the Spartans: yet, by keeping for some time on the defensive, they improved so much, that in three years time they found themselves in a capacity of giving battle to their enemies in the open field: nor did they appear to be in any degree inferior either in courage or conduct: the war was therefore protracted, with various success, on both sides. At last, both consulted the oracle at Delphi; and received for answer, "that whoever should first dedicate 100 tripods in the temple of Jupiter at Ithome, a strong-hold of the Messenians, should be masters of the country." The inhabitants of Messenia, on hearing this, having no money to make the tripods of brass, fell to cutting them out in wood; but before this could be accomplished, a Spartan having got into the city by stratagem, dedicated 100 little tripods of clay: which threw the Messenians into such despair, that they at last submitted to the Spartans.

The new subjects of Sparta were treated with the utmost barbarity by these cruel tyrants; so that a new war commenced under Aristomenes, a man of unconquerable valour, and enthusiastically fond of liberty. He perceived that the Argives and Arcadians, who were called the *allies* of the Lacedæmonians, adhered to them only through fear of their power; but that in reality they hated them, and wished to revenge the injuries they had done them. To these Aristomenes applied; and receiving an answer conformable to his wishes, he engaged his countrymen unanimously to take up arms. About a year after the revolt began, and before either party had received any auxiliaries, the Spartans and Messenians met at a village called *Deræ*, where an obstinate engagement ensued. Aristomenes was conceived to have performed more than mortal atchievements: in gratitude therefore, respect being also had to his royal descent, his countrymen unanimously saluted him *king*; which title he modestly waved, alleging, that he took up arms to set them free, and not to make himself great; he consented however, to accept the title of *general*, with a power of doing whatsoever he thought requisite for the service of the public. Knowing well the superstition of the age in which he lived, he resolved to intimidate the Spartans, by showing them what he was sure they would take for an ill omen. Disguising himself therefore, he went privately to the city, where, in the night, he hung up a shield on the wall of the temple of Minerva, with this inscription: *Aristomenes dedicates this, out of the Spoils of the Spartans, to the goddess*. It was easily perceived thas this war would be both long and bloody; the Lacedæmonians therefore sent deputies to Delphi, to inquire of the oracle concerning its event: the answer they received was, *That it behoved the Spartans to seek a leader from Athens*. The Athenians, naturally envious of the Spartans, granted their request indeed, but in such a manner as manifested their spite; for they sent them for a general Tyrtæus, a schoolmaster and poet, lame of one foot, and who was suspected to be a little out of his wits. But here their skill failed them: for this captain, notwithstanding his despicable appearance, proved of great consequence to Sparta, teaching them how to use good, and how to bear up under evil fortune.

In the mean time, Aristomenes had drawn together a mighty army, the Eleans, Argives, Sicyonians, and Arcadians, having sent troops to his assistance; the Spartans in this, as in the former war, having no ally but Corinth. The Spartan kings, according to the custom of their city, no sooner took the field, than, notwithstanding their inferiority in number, they offered the enemy battle, which Aristomenes readily accepted.—It was long, obstinate, and bloody; but in the end the Messenians were victorious, and the Lacedæmonians put to flight with a great slaughter. It is scarce to be conceived how much the Spartans were struck with this defeat, they grew weary of the war, dissatisfied with their kings, diffident of their own power, and in a word sunk into a state of general uneasiness and want of spirit. It was now that the Athenian general convinced them, that he was capable of fulfilling all the promises of the oracle; he encouraged them by his poems, directed them by his counsels, and recruited their broken armies with chosen men from among the Helotes. Aristomenes, on the other hand, acted with no less prudence and vigour. He thought it not enough to restore the reputation of the Messenians, if he did not also restore their wealth and power: he therefore taught them to act offensively against their enemies; and, entering the territories of Sparta, he took and plundered Pharæ, a considerable borough in Laconia, putting all such as made any resistance to the sword, carrying off at the same time an immense booty. This, however, was an injury which the Spartans could not brook with patience; they therefore sent immediately a body of forces to overtake the Messenians, which accordingly they did: but Aristomenes routed these pursuers, and continued to make a mighty slaughter of them, till such time as he was disabled by having a spear thrust in his side, which occasioned his being carried out of the battle. His cure, which took up some time, being finished, he resolved to carry the war even to the gates of Sparta; and to that purpose raised a very great army: but, whether he found his design impracticable, or was really diverted by some dream, he gave out that Castor and Pollux, with their sister Helena, had appeared to him, and commanded him to desist. A short time after this retreat, going with a small party to make an incursion, and attempting to take prisoners some women who were celebrating religious rites near Egila, a village in Laconia, those zealous matrons fell upon him and his soldiers with such fury, that they put them to flight, and took him prisoner:

Messenia. prisoner: however, he soon afterwards made his escape, and rejoined his forces. In the third year of the war, the Spartans with a great force entered Messenia, whither Aristocrates king of Arcadia was come, with a great body of troops, to the assistance of his allies: Aristomenes therefore made no difficulty of fighting when the Spartans approached; but they entering privately into a negociation with Aristocrates, engaged him with bribes and promises to betray his confederates. When the battle began, the deceitful Arcadian represented to the forces under his command the mighty danger they were in, and the great difficulty there would be of retreating into their own country in case the battle should be lost: he then pretended that the sacrifices were ominous; and, having terrified his Arcadians into the disposition of mind fittest to serve his purpose, he not only drew them off from both wings, but, in his flight, forced through the Messenian ranks, and put them too in confusion. Aristomenes and his troops, however, drew themselves into close order, that they might defend themselves the best they could: and indeed they had need of all their valour and skill; for the Lacedæmonians, who expected this event, immediately attacked and surrounded them on all sides. Fortune was, on this occasion, too powerful either for the courage or the conduct of the Messenians; so that, notwithstanding their utmost efforts, most of their army were cut to pieces and amongst them the chief of their nobility. Aristomenes, with the poor remains of his shattered forces, retired as well as he could; and, perceiving that it was now impossible to maintain the war against the Lacedæmonions upon equal terms, he exhorted his countrymen to fortify mount Era, and to make the best dipositions possible for a long defence. He likewise placed garrisons in Pylus and Methone on the sea-coasts; and to these three places he gathered all the inhabitants, leaving the rest of Messenia to the mercy of the Spartans. They, on the other hand looked on the war as now in a manner finished; for which reason they divided the lands among their citizens, and caused them to be carefully cultivated, while they besieged Era. But Aristomenes quickly convinced them that the war was far from being over: he choose out of all the Messenians 300 men, with whom he ravaged all the adjacent country; carried off a prodigious booty; and, when Messenia could no longer supply the wants of his garrison, penetrated into Laconia, and bore away corn, wine, cattle, and whatever else was necessary to the subsistence of his countrymen shut up in Era: so that at last the Spartans were constrained to issue a proclamation, forbidding the cultivation, not only of the Messenian territory in their hands, but also of Laconia in its vicinity; whereby they distressed themselves more than their enemies, inducing at last a famine in Sparta itself which brought with it its usual attendant, sedition. Here again all things had gone wrong, if the wisdom of the poet Tyrtæus had not supported the Spartan courage; nor was it without much difficulty that he influenced them to continue the blockade of Era, and to maintain a flying camp for the security of the country.

Aristomenes, in spite of all these precautions, committed terrible depredations with his small corps of 300 men. Amongst other places which he plundered, the city of Amyclæ was one; from whence he carried not only a great quantity of riches, but also many carriages laden with provisions. The kings of Sparta lying with their troops in its neighbourhood, as soon as they heard of this expedition, marched after Aristomenes with the utmost diligence; and, as the Messenians were encumbered with their booty, came up with them before they could reach Era. In this situation of things, Aristomenes, prompted rather by despair than prudence, disposed his troops in order of battle; and, notwithstanding they were so few, made a long and vigorous resistance against the whole Lacedæmonian army. At length, however, numbers prevailed: the greatest part of the Messenians were slain on the spot: and Aristomenes, with about 50 of his men who survived the slaughter, were taken prisoners; that chief having received so many wounds, that he was senseless when they carried him away. The Lacedemonians expressed the loudest joy at the sight of this illustrious captive; who for so many years, by his single abilities, had enabled his exhausted country to defend itself against the whole force of Sparta. When he was recovered of his wounds, they decreed him and all his fellow-prisoners to be thrown together into a deep cavern which was the common punishment of the lowest kind of offenders. This judgment was executed with the utmost severity, excepting that Aristomenes had leave to put on his armour. Three days he continued in this dismal place, lying upon and covered over with dead bodies. The third day, he was almost famished through want of food, and almost poisoned with the stench of corrupted carcases, when he heard a fox gnawing a body near him. Upon this he uncovered his face, and perceiving the fox just by him, he with one hand seized one of its hind legs, and with the other defended his face, by catching hold of its jaw when it atempted to bite him. Following as well as he could his straggling guide, the fox at last thrust his head into a little hole; and Aristomenes then letting go his leg, he soon forced his way through, and opened a passage to the welcome rays of light, from which the noble Messenian had been so long debarred. Feeble as he was, Aristomenes wrought himself an outlet with his nails; and travelling by night with all the expedition he could, at length arrived safe at Era, to the great joy and amazement of his countrymen. When this news was first blazed abroad, the Spartans would have had it pass for a fiction; but Aristomenes soon put the truth of it out of doubt, by falling on the posts of the Corinthians, who, as allies of the Spartans had a considerable body of troops before Era. Most of their officers, with a multitude of private men, he slew; pillaged their camp; and, in short did so much mischief, that the Spartans, under the pretence of an approaching festival, agreed to a cessation of arms for 40 days, that they might have time to bury their dead. On this occasion, Aristomenes for the second time celebrated the *hecatomphonia*, or the sacrifice appointed for those who had killed 100 of the enemy with their own hands. He had performed the same before and after his second battle; and he lived to do it a third time: which must appear wonderful to the reader, when he is informed, that, notwithstanding this truce, certain Cretan archers in the service of the Spartans

tans seized Aristomenes as he was walking without the walls, and carried him away prisoner. There were nine of them in all: two of them immediately flew with the news to Sparta, and seven remained to guard their prize, whom they bound, and conducted to a lone cottage inhabited only by a widow and her daughter. It so fell out, that the young woman dreamt the night before, that she saw a lion without claws, bound, and dragged along by wolves; and that she having loosed his bonds, and given him claws, he immediately tore the wolves to peices. As soon as Aristomenes came into the cottage, and her mother, who knew him, had told her who he was, she instantly concluded that her dream was fulfilled; and therefore plied the Cretans with drink, and, when they were asleep, took a poinard from one of them, cut the thongs with which Aristomenes was, bound, and then put it into his hands. He presently verified her vision, by putting all his guards to death; and then carried her and her mother to Era, where, as a reward for her service, he married the young woman to his son Gorgus, then about 18 years of age.

When Era had held out near eleven years, it fell into the hands of Sparta by an accident: the servant of one Empiramus, a Spartan commander, driving his master's cattle to drink at the river Neda, met frequently with the wife of a Messenian, whom he engaged in an amour. This woman gave him notice that her husband's house was without the wall: so that he could come to it without danger, when the good man was abroad; aud she likewise gave him intelligence when her husband was upon duty in the garrison. The Spartan failed not to come at the time appointed; but they had not been long in bed before the husband returned, which put the house into great confusion: the woman, however, secured her gallant; and then let in her husband, whom she received in appearance with great joy, inquiring again and again by what excess of good fortune she was blessed with his return. The innocent Messenian told her, that Aristomenes being detained in his bed by a wound, the soldiers knowing that he could not walk the rounds, had a grant to retire to their houses, to avoid the inclemency of the season. The Spartan no sooner heard this, than he crept softly out of doors, and hastened away to carry the news to his master. It so happened, that the kings were at this time absent from the camp, and Empiramus had the chief command of the army. As soon as he received this information, he ordered his army to begin its march, though it rained excessively, and there was no moon light. The fellow guided them to the ford, and managed matters so well that they seized all the Messenian posts: yet after all, they were affraid to engage: darkness, an high wind, heavy rain, together with the dread af Aristomenes, keeping them quiet in the places they had seized. As soon as it was light, the attack began: and Era had been quickly taken, if only the men had defended it; but the women fought with such fury, and by their mingling in the fray, brought such an accession of numbers, as made the event doubtful. Three days and two nights this desperate engagement lasted: at last, all hopes of preserving the city being lost, Aristomenes drew off his wearied troops. Early the fourth morning, he disposed the women and children in the centre, the Messenian youth in the front and rear, the less able men in the main body: himself commanded the van; the rear-guard was brought up by Gorgus and Manticlus, the former the son of Aristomenes, the latter of Theocles, a Messenian of great merit, who fell with much glory in this attack, fighting valiantly in the cause of his country. When all things were ready, Aristomenes caused the last barrier to be thrown open; and, brandishing his spear, marched directly towards the Spartan troops in order to force a passage. Empiramus, perceiving his intent, ordered his men to open to the right and left, and fairly gave them a passage; so that Aristomenes marched off in triumph, as it were, to Arcadia.

The Arcadians, when they heard that Era was taken were very desirous of succouring their old confederates in this deep distress: they therefore intreated their king Aristocrates to lead them into Messenia. But he, corrupted by the Lacedæmonians, persuaded them that it was too late; that the Messenians were all cut off; and that such a step would only expose them to the fury of the conquerors. When the thing appeared to be otherwise, and it was known that Aristomenes was on the frontiers of Arcadia, they went in crowds to carry him provisions, and to testify their readiness to afford him and those under his command all the assistance in their power. Aristomenes desired to be heard before a general assembly; which being accordingly convoked, he there opened one of the boldest and best-laid schemes recorded in history: he said, that he had yet 500 undaunted soldiers, who at his command, would untertake any thing; that it was very probable most of the Spartans were employed in pillaging Era, and that therefore he determined to march and surprise Sparta; which appeared so sensible that all the assembly loudly commended his great capacity and unshaken courage. Aristocrates, however, took care to betray him: having, by various pretences, retarded the execution of the project. The Arcadians, who began to suspect him, waited for and surprised the messengers as they came back. They took the letters from him and read them openly in the assembly. The purport of them was, that they acknowledged his great kindness both now and in the battle; and promised, that the Lacedæmonians would be grateful. As soon as the letters were read, the Arcadians fell to stoning their king, frequently calling upon the Messenians to assist them; which, however, they did not, waiting for Aristomenes's orders; who, far from triumphing in this spectacle, stood still, with his eyes fixed on the ground, which he wet with his tears, his soul pierced with sorrow to see a crowned head so shamefully and so deservedly put to death. The Arcadians afterwards erected a monument over him, with an inscription to perpetuate his infamy. As for the Messenians under the command of Gorgus and Manticlus, they passed over into Sicily; where they founded the city of Messene, one of the most famous in the island. Aristomenes remained, however, in Greece; where he married all his daughters, except the youngest, to persons of great rank. A prince of Rhodes, inquiring of the oracle at Delphi whom he should espouse, that his subjects might be happy under his posterity, was directed

Messiah. directed to marry the daughter of the most worthy of the Greeks; which answer was immediately understood to point at the virgin daughter of Aristomenes. Her therefore he demanded, and received; Aristomenes accompanying him back to his dominions, where he formed a scheme of uniting the Lydians and Medes against the Spartans, resolving with this view to go into Media, and to the court of Sardis; but while he meditated these great things, death surprised him, and thereby freed Lacedæmon from the most formidable enemy she ever had.

MESSIAH, a word signifying one *anointed*, or installed into an office by unction. It was usual among the Jews to anoint kings, high-priests, and sometimes prophets, at the designation or installment of them, to signify emblematically the mental qualifications necessary for discharging these offices. Saul, David, Solomon, and Joash, kings of Judah, received the royal unction. Aaron and his sons received the sacerdotal, and Elisha the disciple of Elijah received the prophetic unction.—The name MESSIAH, *Anointed*, or *Christ* (Χριστος), was given to the kings and high-priests of the Jews. The patriarchs and prophets are also called by the name of *Messiahs*, or the *Lord's anointed*. See 1 Sam. xii. 3, 5. 1 Chron. xvi. 22. Ps. cv. 15.

But this name MESSIAH was principally and by way of eminence given by the Jews to their expected great Deliverer, whose coming they still vainly wait; and is a name the Christians apply to *Jesus Christ*, in whom the prophecies relating to the Messiah were accomplished. The sum of these prophecies is, that there should be a glorious person named *Messiah*, decended from Abraham, Isaac, and Jacob, who should be born at Bethlehem, of a virgin of the family of David, then in its decline, before the Jews ceased to be a people, while the second temple was standing, and about 500 years after Ezra's time; who though appearing in mean circumstances, should be introduced by a remarkable forerunner, whose business it should be to awaken the attention and expectation of the people. That this illustrious person called *Messiah* should himself be eminent for the piety, wisdom, and benevolence of his character, and the miraculous works he should perform; yet that, notwithstanding all this, he should be rejected and put to death by the Jews; but should afterwards be raised from the dead, and exalted to a glorious throne, on which he should through all generations continue to rule, at the same time making intercession for sinners. That great calamities should for the present be brought on the Jews for rejecting him: whereas the kingdom of God should by his means be erected among the Gentiles, and disperse itself even unto the ends of the earth; wherever it came destroying idolatry, and establishing true religion and righteousness. In a word, That this glorious person should be regarded by all who believed in him as a divine teacher, an atoning sacrifice, and a royal governor: by means of whom God would make a covenant with his people, very different from that made with Israel of old; in consequence of which they should be restored to, and established in, the divine favour, and fixed in a state of perpetual happiness. See *Jesus Christ*, and CHRISTIANITY.

The Jews, as was already observed, still wait for the coming of the *Messiah*, being infatuated with the notion of a temporal *Messiah*, who is to be a mighty conqueror, and to subdue all the world. Most of the modern rabbins, according to Buxtorf, believe that the *Messiah* is already come, but that he keeps himself concealed, and will not manifest himself because of the sins of the Jews. Some of the Jews, however, in order to reconcile those prophecies that seem to contradict each other as to the character and condition of the *Messiah*, have had recourse to the hypothesis of two *Messiahs*, who are yet to succeed each other; one in a state of humiliation and suffering; the other of glory, splendor, and power. The first, they say, is to proceed from the tribe of Ephraim, who is to fight against Gog, and to be slain by Annillus, Zech. xii. 10. The second is to be of the tribe of Judah, and lineage of David, who is to conquer and kill Annillus, and restore the kingdom of Israel, reigning over it in the highest glory and felicity.

Jesus Christ asserts himself the *Messiah*. In St John iv. 25. the Samaritan woman says to Jesus, *I know that when* Messiah *comes who is called* the Christ, *he will tell us all things. Jesus answered her, I that speak to thee am he.*

There are several impostors, who have endeavoured to pass for *Messiahs*, as Christ himself predicted. J. Lent, a Dutchman, has written a history *De Pseudomessiis*, "Of false Messiahs." The first he mentions was one Barcochab, who appeared under the empire of Adrian. The last was rabbi Mordecai, who began to be talked of in 1682. A little before him, viz. in 1666, appeared Sabbethai Sebi, who was taken by the Turks, and turned Mahometan.

MESSINA, an ancient, large, handsome, and strong city of Sicily, and in the Vall-di-Demona, with a citadel, several forts, a fine spacious harbour, and an archbishop's see. It is seated on the sea-side, 110 miles east of Palermo, 260 south by east of Rome, and 180 south-east of Naples. E. Long. 15. 50. N. Lat. 38. 10. The public buildings and the monasteries were numerous and magnificent, and it contained about 60,000 inhabitants; the harbour is one of the safest in the Meditterranean, and extremely deep; the viceroy of Sicily resides here six months in the year; and it was a place of great trade in silk, oil, fruit, corn, and excellent wine, especially since it was declared a free port. This city in the beginning of the year 1783 suffered most dreadfully by the earthquakes, which shook great part of Calabria and Sicily to their foundations, overturned many rich and populous towns, and buried thousands in their ruins: (see CALABRIA and EARTHQUAKE.)—The following account of Messina, as it stood before the above period, is extracted from Mr *Swinburne's Travels in Sicily*.

A large chain of mountains presses upon the shore, and part of the city stands upon elevated ground. The mountains are many of them nobly wooded; the hills before them finely chequered with groves and fields. As the town runs in a sweep along the edge of a declivity, every building of consequence is seen to advantage, while the less noble parts are hidden by the Palazzata. This is a regular ornamental range of lofty houses, with 19 gates, answering to as many streets: it follows the semicircular bend of the port for one mile and five poles, and would have been the handsomest line of buildings in Europe had the design been com-

Messina. compleated; but a considerable part of the extent is not finished, except merely in the front wall, and that seems to be in a very ruinous condition. Philibert Emmanuel of Savoy, viceroy of Sicily, in 1622 began this princely work. Before it is a broad quay, decorated with statues and fountains; ships of any burden can moor close to the parapet in great depth of water. At the west extremity is a small fort and a gate; the other end is closed by the governor's house and the citadel, a modern pentagonal fortress, built on the point where the isthmus or *braccio di San Raneiro* issues from the main land. On this slip of low ground, which with the Palazzato forms the circular harbour of Messina, are placed the light-house *(lazaretto)*, and on the point the old castle of St Salvatore. The circumference of the port is four miles: it probably owes its formation to an earthquake, which opened an immense chasm, and then filled it with water. Near the light-house is a kind of whirlpool in the sea, shown as the Charybdis of the ancients.

The inner part of Messina is dirty, though it contains a considerable number of neat churches and large substantial dwellings. The cathedral is Gothic, enriched with Saracenic mosaics on the altars and shrines; the front of the high altar is particularly splendid: Gagini has embellished the pulpit and some tombs with excellent specimens of his art.—In the treasury of this church is preserved the palladium of Messina, a letter from the Virgin Mary to its citizens (A). This is the title upon which the Messinese build their pretensions to pre-eminence over the whole island, nay over the whole world; to its virtues and patronage they attribute every piece of good fortune, and to their own unworthiness all sinister events that have befallen them. The authenticity of this epistle has been seriously impugned, and of course vigorously defended by many Sicilian divines and disputators.

There is another church in this city that deserves particular notice, not so much on account of its architecture or ornaments, as for its being the last refuge of the Greek liturgy, which was once the predominant service of the island, but gradually abolished by different conquerors. It is dedicated to the Virgin Mary de Grapheo, or of the *Letter*, which denomination may perhaps have furnished Lascaris with the idea of his letter. It is known at present by the name of *la Cattolica*. According to the Greek canons, the entrance of monastic churches was reciprocally forbidden to each sex, and the cathedrals were the only places of worship where a daily sacrifice was offered up by the bishop and clergy, and where both men and women were present at the same time, but in different parts of the church. From this general admittance the building acquired the title of *Catholic* or *universal*.

Messina is all paved with lava, cut into large flags of two feet square: a material which the vicinity of lavas render it easy to procure, and which being very hard resists friction better than any other.

During a series of ages, notwithstanding the various revolutions and calamities to which it has been exposed, this city has still maintained its original situation; while most other cities have shifted their ground more or less from the place where they were first founded. But its situation enjoys advantages which have still tempted such of its inhabitants as escaped from the ravages of war and the desolation of earthquakes, to prefer it to every other spot, however delightful or secure. It is of very ancient origin; and has been under many different races of monarchs; and its name has been repeatedly changed: It has been at different times called *Zanclé*, *Mamertina*, *Messana*. Its first name *Zanclé*, which in the old language of Sicily meant "a sickle;" alluding, as some authors suppose, to the form of the port; or, according to authors, to the

(A) The story is as follows; After St Paul had made some stay at Messina (a circumstance of his travels unnoticed by St Luke), the Messinese prevailed upon him to return to Jerusalem with an embassy of four persons sent by the city to the Virgin Mary. Their excellencies were graciously received by her, and brought back a letter written with her own hand in the Hebrew tongue, which St Paul translated into Greek. By the irruption of the Saracens this invaluable treasure was lost, and utterly forgotten till the year 1467, when Constantine Lascaris, a refugee Greek, found a copy of it, and turning it into Latin, made it known to the citizens, and then to all the Catholic world. Its authenticity is now so well established at Messina, that Regna the historian candidly acknowledges, that whoever was to confess even a doubt on the subject in that city would be treated as an infidel.

This curious epistle is conceived in these terms: Maria Virgo Joachum filia, Dei humillima Christi Jesu crucifixi Mater, ex tribu Judæ stirpe David, Messanensibus omnibus salutem, et Dei patris omnipotentis benedictionem. Vos omnes fide magna legatos ac nuncios per publicum documentum ad nos misisse constat. Filium nostrum Dei genitum Deum et hominem esse fatemini, et in cœlum post suam resurrectionem ascendisse, Pauli apostoli electi prædicatione mediante viam veritatis agnoscentes. Ob quod vos et ipsam civitatem benedicimus cujus perpetuam protectricem nos esse volumus. Anno filii nostri XLII. Indict. I. III. Nonas Junii, luna XXVII. feria V. ex Hyerosolymis.

Thus translated:—"The Virgin Mary, daughter of Joachim, most humble mother of God, Jesus Christ crucified, of the tribe of Juda and the family of David, health and the blessing of God the father Almighty to all the people of Messina. Out of the abundance of your faith, you have, in consequence of a public deliberation, sent a deputation to me; and since you acknowledge that my Son is both God and man, and that he ascended into heaven after his resurrection, as you have learned from the preaching of St Paul the apostle, I give my blessing to you and all your city, and agree to become your protectress. In the 42d year of my Son, the 1st of the Indiction, the 3d day of June, and the 27th of the moon, at Jerusalem."

Not to dwell upon the astronomical blunders in these dates, let it suffice to observe, that Lascaris was not aware that Denis the Little, a Syrian monk in the 6th century, was the first who made use of the era that commences our Saviour's birth.

Messina. the fertility of the country. Allured by the advantages of its situation, the Cumæans, a commercial and enterprising people, invaded the island and drove the Siculi from this settlement; they were in their turn overpowered by a band of Samian adventurers, who made way for a colony of citizens of Messene, and under these masters it changed its name to *Messana*. Their government was of short duration; for in the 29th year before Christ it was destroyed by the Mamertines, a warlike unprincipled nation inhabiting the south part of Brutium. These soldiers being received into Messana on their return to Italy from Syracuse, where they had served as mercenaries in the army of Agathocles, took an opportunity of massacring the inhabitants and usurping their possessions. The city was now called *Mamertina*; and, in order to support themselves against the resentment of the Sicilian powers, the Mamertines implored the protection of the Romans, who eager to extend their dominion beyond the limits of Italy, and jealous of the growing power of Carthage, made no scruple to succour these assassins with a consular army. This step brought on the first Punic war. The Mamertines reaped no other fruit from the alliance but a more honourable degree of slavery; for such was the real nature of their connection with Rome, whatever name it might be disguised under.

Messina was, however, always distinguished by particular attentions and favours from the senate, and, excepting a short period during the wars of the triumvirate, appears to have tasted all the sweets of Roman prosperity, without partaking of the bitter draughts of adversity. Its fate, in the ruin of the empire, was similar to that of the rest of Sicily. In 829 Messina fell into the hands of the Saracens, but obtained very honourable terms of capitulation; for half the city was left to the Christians, where they were to be governed by their own laws, and profess their own religion undisturbed. In the other resided the bey of one of the five provinces into which the Arabian conquerors had divided the island. Notwithstanding this indulgence, Messina was the first to cast off the yoke in 1037, when George Maniaces landed an army of Greeks and Normans on the shore of the Faro. It afterwards held out against the whole Mussulman force till the feeble state of a distracted empire shut out all hopes of assistance from Constantinople. This unfortunate city then opened its gates to the army of the caliph, and felt very severely the weight of his resentment; but it did not long groan under the yoke; for in less than 20 years Roger the Norman took it by surprise and delivered it from Mahometan oppression. During the crusado our Richard Cœur de Lion and Philip Augustus king of France wintered here in their way to palestine; a sojourn marked by continual quarrels, conflagration, and bloodshed. The Messenese were particularly tardy in entering into the national conspiracy of 1282, but afterwards exceeded the rest of the insurgents in deeds of cruelty: This and the importance of their situation singled them out for the first objects of Charles's vengeance. He invested their city very closely, and declared so openly his determination to refuse all terms whatever to the besieged that they saw no hopes of safety but in an obstinate defence. Their courage, perseverance, and sufferings were excessive; at length their strength and resources began to fail rapidly, and every circumstance seemed to denounce their speedy destruction, when Roger Lauria appeared off the harbour with the Arragonian fleet, forced the king to retire with precipitation across the straits, and in his sight defeated and destroyed his naval armament. Robert, grandson of Charles I. also made a fruitless attack; but in the disturbed reign of Frederick III. Messina was delivered up to Louis king of Naples and his consort queen Joan, who entered it in triumph. In a few years it returned to its former possessors. The year 1672 was remarkable for the revolt of the Messinese.—They threw off the Spanish yoke, and swore allegiance to Louis XIV. king of France. They were for some time vigorously assisted by the French; but before the Spaniards had gained the least advantage to excite any hopes of recovering so valuable a possession, Louis found himself necessitated from motives of political interest to desert his new subjects, and leave them to the mercy of their old incensed masters. The horror of being thus abandoned, and the chastisement inflicted by Spain, broke the fierce spirit of the Messinese; they were still stunned with the remembrance and effects of this blow, when the plague in 1743 was introduced from the Levant and swept away more than half the inhabitants. From this chain of calamities, the opulence, trade, and population of Messina, have been gradually sinking; and unless very favourable circumstances happen, will every year fall lower. The number of its inhabitants does not now exceed 30,000.

The following particulars are added from M. Houel, who visited this city since the late earthquakes, which completed its destruction.

On the front of the cathedral there is a square, which though not regular, is far from being mean. This was not the largest square in Messina before its overthrow; but it was the most elegant, the most splendidly adorned, and the best frequented. There stands in this square an equestrian statue of Charles II. of Spain, in bronze, which has been spared by the earthquake. It stands on a marble pedestal, in the middle of the square. Opposite to this statue is an elegant marble fountain, ornamented with a variety of figures representing men and other animals, all of them spouting out water in great abundance; which used, in summer, to spread an agreeable and refreshing coolness over the square, that induced company to assemble here. Seven streets terminated here. The cathedral forms a part of the square. It is dedicated to the blessed Virgin; the occasion of which has been already mentioned.

There is an anniversary feast celebrated in Messina, which is called *the feast of the Letter*. A lock of the Virgin's hair, which she sent to the Messenians at the same time with the letter, is carried through the city in procession in a crystal vessel. She made also a present of her picture to the Messenian deputies. It is placed over the tabernacle. None but the canons of the cathedral are permitted to touch, or take up on their shoulders, the silver shrine in which the crystal vessel with the virgin's hair is deposited. Eight of those canons, with mitres on their heads, bear this shrine in the procession. The canopy suspended over it is supported by six senators in their robes. The picture

Messina. picture and the hair are shown to strangers. This procession and the other religious ceremonies of this festival are followed by horse races. The spirits of the people being already elevated by their religious exercises, they engage with amazing eagerness in these and the other diversions with which they are accompanied: a tumultuous joy reigns over the city: and the evening concludes with illuminations and fire-works. The ships in the harbour pay the citizens the compliment of entertaining them with a discharge of their guns on the occasion.

Through a square called *the Square of the Great Hospital*, runs a large and impetuous torrent, the *Porto delle Legni*. It is precipitated from those lofty mountains which overlook this city on the south side. The channel which it has cut out for itself is at times entirely full. It would, on such occasions, overflow the square and other parts of the city, were it not confined by walls which have been built on both sides to prev ent such accidents.—Another stream of a similar origin, called the *Torrent of La Boccetta*, runs through another part of the city; it is also confined within the walls to prevent it from overflowing.

The *Square of St John of Malta* is one of the largest in Messina. In the middle of this square is a fine marble fountain, ornamented with a variety of sculptured figures and jets d'eau. Beside the fountain there used to stand a large reservoir for horses to drink out of.

In the time of the annual festivals, there used to be exhibited on the waters of the reservoir a galley, or rather a fictitious representation of a galley, with galley-slaves, soldiers, officers, and a commander on board, all in arms, and the galley properly equipped as a ship of war. This galley was decorated with great art; and by night the masts, and every other suitable part, were hung with lamps, which illumined it in a very splendid manner. Every thing around was so artificially disposed, that when the fire-works were played off, the spectator was led to think, though he perceived only one galley, that the noise which he heard was produced by a naval combat; and that the other ships were concealed from his view by the smoke occasioned by the guns and fire-works. This, when properly conducted, was a noble spectacle. The senate repaired thither from the cathedral, attended with a guard and a numerous company. In one carriage six senators, the governor of the city, and sometimes the archbishop. It was exceedingly large, and drawn by six white horses very richly harnessed. Other carriages followed, with the train who attended the governor and the senators.

Almost all festivals owe their origin to some extraordinary event, or some singular story either true or false. It is said, that when the splendor with which the feast of *the assumption de la Bera* was celebrated at Messina, first began to attract foreigners to the city, on that occasion such crowds repaired thither as to alarm the inhabitants with the fears of a famine: But one year, when the number of strangers was greater than usual at the time of this festival, the magistrates were very much at a loss how to supply them with provisions; and at length, every other resource failing no hopes of relief remained but from the kindness of the Blessed Virgin. Fervent prayers were addressed to their patroness: and next morning by day-break three brigantines appeared entering the harbour with full sails. They proved to be loaded with corn. It was eagerly purchased: and the people of the city hasted to appease their hunger. But when they came after refreshing themselves to pay the corn-merchants their money, neither ships nor merchants could be found. After their first emotions of surprise had subsided, they naturally concluded that such a seasonable supply must undoubtedly be a present from the Virgin, who, being pleased with the zeal of her Messenian votaries, and desirous to prevent the concourse of strangers who attended the festival from diminishing, had interposed in this miraculous manner to save them from the distresses of famine. A new festival was celebrated in gratitude to their generous benefactress. Three small vessels of silver were made, and dedicated to the Virgin in memory of the event; and these are at present used as lamps in the cathedral. The senate likewise decreed, that the clergy should pay annually a small tax, to be laid out in constructing a small galley to swim on the fountain, and in defraying the expences of the fire-works. The profits of the clergy are so considerable on the occasion of the festival, that they may be supposed to pay the tax with great cheerfulness.

In Messina, as in the other cities of Sicily, the women wrap themselves in a large black mantle above the rest of their dress. The stuffs are richer or plainer according to rank and circumstances. People who are not rich enough to have fine cloaths of their own, hire them at so much an hour. There are women who make a livelihood by lending out their cloaths. The mantle covers the wearer from head to foot.—It reduces the old and the young, the ill-shaped and the handsome, pretty much to an equality in point of appearance. This must naturally appear very unfavourable to the influence of beauty. But yet, on proper occasions, at church or in a public walk, the ladies of Messina find means to open and adjust the mantle so as to display all their beauties of face and shape, and to attract the affections of lovers, perhaps more powerfully than if their dress were suited to display their charms in a more ostentatious manner.

Between Messina and the tower of Faro there stands a small church called the *Madona of the Grotto*. It was anciently a temple of a round structure, and ornamented with columns like the temple of the sun at Rome. Modern columns now supply the place that was occupied by the ancient. There are large niches in the rock adjoining to the temple, which are thought to be of equal antiquity. These contain no sculptured figures; but in Pagan times they might possibly contain some.

Messina being situated between mount Ætna and the gulph of Charybdis, and being likewise at no great distance from the volcanoes of Lipari and Stromboli, must have been in all ages liable to suffer by earthquakes. Such terrible events, however appear to have been more unfrequent in ancient than in modern times, and have actually alarmed the presentage oftener than any other. In 1693 a fourth part of the cities of Sicily was destroyed by an earthquake. Messina merely felt the shock: all its buildings, however, suffered. In the year 1742 it suffered another equally violent. A plague which followed in 1743 retarded the repairs necessary after the earthquake. In the year

Meſſina.

year 1780 this city continued, for more than ſix months, to ſuffer from a new earthquake.

Were the ſtate of the elements, previous to theſe dreadful events, carefully examined, it might perhaps be found to undergo certain changes which might be conſidered as prognoſticating them.

The autumn of the year 1782 was unuſually cold and rainy. Fahrenheit's thermometer was often as low as 56 degrees. The ſucceeding winter was dry; and the mercury never fell under 25 degrees: And, what is uncommon in that ſeaſon, ſtorms were now and then obſerved to ariſe from the weſt. The pilots in the channel obſerved that the tides no longer roſe at the uſual periods, and the gulph of Charybdis raged with extraordinary fury.

On the 5th of February 1783, the air was heavy and calm; the ſky obſcured with thick clouds, and the atmoſphere ſeemingly all in a flame. About half after twelve at noon the earth began to ſhake with a dreadful noiſe. The ſhocks continually increaſed, and became at length ſo violent as to open the ground, and to overturn in two or three minutes a conſiderable part of the buildings.

A long white cloud appeared to the north-weſt; and ſoon after another, very dark, in the ſame quarter of the heavens. The latter in a moment ſpread over the whole horizon, and deluged the city with rain and hail, accompanied with dreadful claps of thunder. The inhabitants fled in the utmoſt terror to the fields and the ſhips in the harbour.

From mid-day till five in the afternoon the earthquake continued almoſt without interruption. The ſhocks then became ſomewhat leſs frequent. The cries of the dying; the ſhrieks of thoſe who were half-buried under the ruins; the wild terror with which others, who were ſtill able, attempted to make their eſcape; the deſpair of fathers, mothers, and huſbands bereft of thoſe who were deareſt to them; then formed altogether a ſcene of horror, ſuch as can but ſeldom occur in the hiſtory of the calamities of the human race. Amid that awful ſcene, inſtances of the moſt heroic courage and the moſt generous affection were diſplayed. Mothers, regardleſs of their own ſafety, ruſhed into every danger to ſnatch their children from death. Conjugal and filial affection prompted deeds not leſs deſperate and heroic. But no ſooner did the earthquake ceaſe, than the poor wretches who had eſcaped began to feel the influence of very different paſſions. When they returned to viſit the ruins, to ſeek out the ſituation of their fallen dwellings, to inquire into the fate of their families, to procure food and collect ſome remains of their former fortunes—ſuch as found their circumſtances the moſt wretched became ſuddenly animated with rage, which nothing but wild deſpair could inſpire. The diſtinction of ranks, and the order of ſociety were diſregarded, and property eagerly violated. Murder, rapine, and lawleſs robbery, reigned among the ſmoking ruins.

About one in the morning another ſhock of the earthquake was felt, which overturned moſt of the houſes that were ſtill ſtanding. Moſt of thoſe whom want, or avarice, or humanity, ſtill detained among the ruins, now ſharedthe ſame fate with their friends whom the former ſhocks had buried under them.

The ſucceeding day ſcarce alleviated the diſtreſs of this diſmal night: the few wretches who ſtill ſurvived found themſelves deſtitute of every neceſſary. At length order was in ſome degree re-eſtabliſhed; and in two days after every perſon was ſupplied at leaſt with ſome ſmall portion of the neceſſaries for ſubſiſtence.

None yet thought of returning to take up their abode among the ruins. The common people fixed their reſidence on the plain of Porta Salvo, near the town of Salleo. The nobles, magiſtrates, and merchants, took up their abode on another plain, on the other ſide of the ſtream Porta de Legno; the ſoldiers at Terra Nuova.

Some violent ſhocks which were again felt on the 7th of February and the 28th of March completed the deſtruction of the city. The corn magazines, however, eſcaped without damage; and the public ovens and the aqueducts were but little injured. From theſe facts it may perhaps be inferred, that had not the houſes of Meſſina been, in general, haſtily built at the firſt, and afterwards careleſsly repaired, fewer of them would have been overthrown by the earthquake.

The neighbouring villages having ſuffered but little, were the firſt to relieve the remaining inhabitants of Meſſina in their diſtreſs. Malteſe galleys for ſome days ſupplied neceſſaries to the poor and the ſick with a generoſity which merits the higheſt praiſe. They brought ſurgeons and whatever was needful for the cure of the wounded. The ſupplies ſent by the king of France were refuſed, for what reaſon we know not. What money was needed for the ſupport of the people was taken from the treaſury of the city of Meſſina; for what the king of Naples ſent was ſeized and ſpent by the garriſon.

It is ſaid that not more than 800 or 900 perſons periſhed by this earthquake. The ſea during that convulſion of the land was ſlightly agitated in the harbour. Farther out the ſea was more violently agitated; but none of the ſhips in the harbour were daſhed to pieces. The waters roſe ſo high as to be injurious in a very conſiderable degree to Pharo, as well as along the coaſt of Scylla and Bagnara.

This earthquake was not of a momentary duration like that by which Liſbon was deſtroyed, and like many others: for more than ſixty days, from the 5th of February to the beginning of April, Meſſina continued to he ſhaken; and in that time felt more than 200 ſhocks. And ever after that period the alarm was again and again renewed. Not only the magiſtrates, the ſoldiers, and the people, but the prieſts likewiſe, with their tabernacle and altar, retired to the barracks. The nuns, too, deſerted their cloiſter, and ſought a retreat without the walls. Some of them confined themſelves to the gardens of their convents; others mixed indiſcriminately with the people.

The chief damage which the public buildings within the city ſuffered was the fall of the dome of the church of Purgatory. Only the walls were left ſtanding: and even theſe had ſuffered conſiderably. One half of the ſteeple of the cathedral was beaten to the ground. The magazines of Porto Franco were likewiſe very much ſhattered. The fort of St Salvator, being built on an artificial foundation, the ſide next the ſea is there fallen down; but on the other ſide where it is

Meſſina || Metacarpus.

founded on a rock, it has ſtood unmoved by all the ſhocks of the earthquake.

On the 5th of February, when the earthquake was more violent than at any time afterwards, a ſtrong ſmell of ſulphur was felt. the earth was affected ſomewhat in the ſame way as if it had been borne upon a fluid; and ſeemed to reel with the ſhocks much like a ſhip toſſed with the waves. This tremulous motion was felt all over Sicily; but towards Pharo it became weaker. On the following days the ſky was cloudy; the mountains of Sicily and the ſhores of Calabria continued covered with a thick fog like ſmoke. North and north-eaſt winds raged with the moſt violent impetuoſity.

The diſaſtrous year of this earthquake was ſcarce concluded, the chaſms which it had opened in the ground were ſtill yawning, and the poor inhabitants of the adjacent country ſtill trembled with terror, when the elements again renewed their fury to ravage this miſerable land.

On Tueſday the 6th of January 1784, about ſunriſe, the wind began to blow ſoftly from the north-eaſt. The ſea gradually ſwelled, roſe beyond its bed with rapid impetuoſity, overflowed the quay of Meſſina, and laſhed with its billows the ruins of the Palazzatta. It looſened and diſplaced many of the ſtones of the mole, ſpread over the whole ſtreet, and attacked the pedeſtals of the ſtatues which had been ſpared by the earthquake, and ſtill ſtood firm among the ruins. The ſame furious wind which ſwelled the ſea in ſo extraordinary a manner, ravaged the whole coaſt from Meſſina all the way to Syracuſe.

MESSUAGE, Messuagium, in law, a dwelling-houſe, with ſome land adjoining aſſigned for its uſe. By the name of *meſſuage* may a garden, ſhop, mill, cottage, chamber, cellar, or the like, paſs.—In Scotland, *meſſuage* denotes what is called in England the *manor houſe*, viz. the principal dwelling-houſe within any barony.

MESOPORPHYRON, a name given by the Greeks to the Roman *laticlave*; becauſe that garment being edged on each ſide, where it opened before, with purple, appeared when cloſed with two purple ſtripes down the middle. The ſame term was alſo applied to the *auguſticlave*.

META, in the Roman circus, was a pile of ſtones of a pyramidical form, intended as a boundary of the *ſtadium*, or chariot courſe.—When the meta was paſſed the ſeventh time, the race was concluded. The greateſt art and management were required in avoiding the meta, and yet going as near it as poſſible. If they went too near, they were in the greateſt danger of breaking the chariot to peices; and if they took too large a circuit in the turn, they gave their rivals an opportunity of getting within them, beſides loſing a great deal of ground. The boundary of the Grecian *ſtadium*, or courſe, was called τεγος, τερμα, γραμμη and απρα γραμμη; to which laſt name Horace probably alludes in calling death, "*ultima linea rerum*."

The *metæ* at Rome were firſt of wood, afterwards of ſtone; but the emperor Claudius made them of gold, or rather guilded them. In the Romau circus there were two *metæ*, one at the entrance of the courſe, and the other at the end of it. An egg was placed upon the top of the *metæ*.

METACARPUS, or Metacarpium, (from μετα *behind*, and καρπος, *hand*), in anatomy, that part of the hand between the wriſt and the fingers. See Anatomy, n° 55.

Metagitnion, Metal.

METAGITNION, the ſecond month of the Athenian year, anſwering to the latter part of our July and the beginning of Auguſt, and ſo called from *metagitnia* a feſtival in honour of Apollo which was kept in it. The Bœotians called this month *panemus*, and the Syracuſans, *carnius*.

METAL, in natural hiſtory, a ſimple, ponderous, ſhining, fixed, opaque body, that fuſes and becomes fluid by fire, and by cold coagulates and hardens into a ſolid maſs capable of being diſtended under the hammer. See Metallurgy, and Chemistry.

Metal, in heraldry. There are two metals uſed in heraldry, by way of colours, viz. gold and ſilver, in blazon called *or* and *argent*.

In the common painting of arms thoſe metals are repreſented by white and yellow, which are the natural colours of thoſe metals. In engraving, gold is expreſſed by dotting the coat, &c. all over; and ſilver, by leaving it quite blank.

It is a general rule in heraldry, never to place metal upon metal, nor colour upon colour: ſo that if the field be of one of the metals, the bearing muſt be of ſome colour; and if the field be of any colour, the bearing muſt be one of the metals.

Metals, Solution of. See Chemistry-*Index*.

On this ſubject Mr Keir has ſome curious obſervations in the Philiſophical Tranſactions for 1790. He takes notice, that the word *ſolution* has two meanings; one expreſſive of the act of diſſolving, as when we ſay that "ſolution is a chemical operation;" and the other, when it is put for the ſubſtance diſſolved in the acid, as a ſolution of ſilver in the nitrous acid." To avoid confuſion, therefore he uſes the word *ſolution* to expreſs the ſubſtance diſſolved, together with its ſolvent: *diſſolution* being the term made uſe of when the act of diſſolving is meant. He continues the uſe of the terms *phlogiſticated* and *dephlogiſticated* to expreſs certain ſtates of the acids, but without reference to theory of any kind.

In diſſolving metals, our author obſerves, that the properties of the ſeveral acids have been inveſtigated with conſiderable ſucceſs; and even one compound, viz. that of ſpirit of nitre and ſpirit of ſalt, commonly called *aqua regis*, is well known on account of its quality of diſſolving gold. A vaſt field, however, yet remains for examination in the other acids, whether mixed together, or poſſeſſing various degrees of concentration, temperature, or phlogiſtication. Thus, tho' no two ſubſtances are more frequently in the hands of chemiſts than vitriolic acid and nitre, yet the properties of the mixture had not been inveſtigated before Mr Keir made his experiments; and upon trial he found, that this mixture poſſeſſed certain properties which neither the vitriolic nor nitrous acids ſingly poſſeſs. The reſults of his experiments on this ſubject are as follow.

1. In a long-necked retort containing 1400 grain meaſures, 100 grains of oil of vitriol of the ſpecific gravity of 1.844 were put along with 100 grains of pure nitre, and the ſalt diſſolved in the acid by means of a water-bath. On applying a boiling heat, the ſilver began to diſſolve, and the ſolution aſſumed a purple or

or violet colour; but no air was extricated. An end was put to the operation (by the rushing in of the water used in the pneumatic apparatus applied to the retort) when 39 grains of silver had been dissolved.

2. To 100 grains of nitre previously dissolved in an equal quantity of vitriolic acid, 200 grains of standard silver were added; of which 92 grains were dissolved without the production of any air or gas: but upon pouring in 200 grains of water into the retort, a violent effervescence took place, and 3100 measures of nitrous gas were thrown off; and on adding 200 grains more a farther emission of 600 grain measures ensued; but no more was emitted on the addition of more water, nor did any farther dissolution of the metal take place than two grains. The same phenomena took place in various proportions, according to the different quantities of acid and metal made use of.

On substituting tin for silver, none of the metal was dissolved or calcined by mixtures in the proportion of 200 grain measures of oil of vitriol to as much nitre, nor by 200 of the vitriolic acid to 150 of nitre: but with a proportion of 200 measures of the acid to 100 grains of nitre, the tin soon began to be acted upon, and diffused through the liquor; but no gas was extricated till the digestion had been continued in boiling water for two hours. The tin was still only calcined, not dissolved; 8500 grain measures of nitrous gas were extricated, and 73 grains of the metal reduced to a white powder. On pouring into the retort 200 grains of fresh water, a new effervescence took place betwixt the water, and white powder, by which 4600 grain measures of nitrous gas were thrown off. The action of the menstruum was greatly promoted by augmenting the quantity of oil of vitriol, and adding water to the mixture.

By this mixture quicksilver was calcined to a grey powder, nickel was also partly calcined and partly dissolved; but no other metal was much affected, tho' the surfaces of some of them were tarnished. The mixtures themselves were very apt to congeal, especially where there was a large proportion of nitre; and their properties are much altered by the addition of water. Thus, in their concentrated state, they do not act upon iron; but by adding water, it acquires the property of acting upon that metal, and in different degrees according to the quantity of water added. Thus, by adding two measures of the compound acid to one of water, the liquor is rendered capable of calcining iron, and forming with it a white powder, but without any effervescence. An equal measure of water produces effervescence; and with a larger proportion of water the iron acquires a yellow or brown colour, such as phlogisticated nitrous acid acquires from iron, or communicates to a solution of martial vitriol in water. Dilution with water renders this compound acid capable of dissolving copper and zinc, neither of which it will touch in its concentrated state.

From this property of the compound acid not dissolving copper, but very readily silver, we have an easy method of separating the two metals from each other. This might be useful in many cases; but is particularly so in Birmingham, where great numbers of copper vessels covered with silver are manufactured. Thus there are always a great number of cuttings or small bits called *scraps*, which are of no use but to separate the two metals from one another. The easiest method of doing this is an object of some consequence. Two methods have been generally practised for this purpose: one is by melting the whole mass of metal with lead, and separating them by means of eliquation and testing; the other is by dissolving both metals in vitriolic acid, and then separating the solution of copper from the vitriol of silver. The disadvantage of the former method is, the quantity of lead and copper wasted; and of the latter, that of vitriolic acid. The virtues of a mixture of oil of vitriol and nitre were some time ago communicated by Mr Keir to an artist at Birmingham; and it is now generally used there to effect the separation of the two metals. The method of using it is very easy; nothing more being requisite than to put the pieces of plated metal into a glazed earthen pan, and to pour upon them some of the acid liquor, which may contain about one pound of nitre to eight or ten of oil of vitriol. Stir them about, and assist the action by an heat from 100 to 200 of Fahrenheit's scale. When the liquor is nearly saturated, the silver may be precipitated in the form of *luna cornea* by common salt; or it may be obtained in its metallic form by adding to the liquor some pieces of copper, and as much water as will enable it to act upon them. He is of opinion, that the menstruum may be useful in all separations of silver from other metals. The name he seems to wish to impose upon it is *aqua regina*. The following are the conclusions drawn from the experiments on these mixtures by our author.

1. A mixture of the vitriolic and nitrous acids dissolves silver plentifully.

2. It acts upon tin, and mostly calcines it, as well as mercury and nickel; having little or no action upon other metals.

3. The quantity of gas produced while the metal is dissolving, is greater, relatively to the quantity of the metal dissolved, when the proportion of nitre to the vitriolic acid is small, than when it is large; and when the metals are dissolved by mixtures containing much nitre with a small production of gas, the solution itself, or the metallic salt formed in it, yields abundance of gas when mixed with water.

4. Dilution with water renders the concentrated mixture less capable of dissolving silver, but more so of acting upon other metals.

5. This mixture of highly concentrated vitriolic and nitrous acids, acquires a purple or violet colour when phlogisticated, either by the addition of inflammable substances as sulphur, or by its action on metals, or by very strong impregnation of oil of vitriol with nitrous gas.

6. By means of this phlogistication the mixture acquired a property of dissolving, though in small quantities, copper, iron, zinc, and regulus of cobalt.

7. Water expels a vast quantity of nitrous gas from a concentrated mixture of vitriolic acid and nitre impregnated with it; but this fluid unites with a mixture of oil of vitriol and nitre without any considerable effervescence.

By adding to the mixture of oil of vitriol and nitre a solution of common salt, a very powerful *aqua regis* is formed, capable of dissolving gold and platina; and which,

Metal. which, though perfectly free from all metallic matter, acquires at once a deep yellow colour. Dry common salt added to the concentrated mixture produces an effervescence, but no yellow colour.

METALEPSIS. See ORATORY, n° 59.

METALLISATION, the natural process by which metals are formed in the bowels of the earth. See METALLURGY, sect. i. Metalensis, Metallisation.

METALLURGY.

METALLURGY, according to Boerhaave, comprehends the whole art of working metals, from the glebe or ore to the utensil; in which sense essaying, smelting, refining, parting, smithery, gilding, &c. are only branches of metallurgy. But, in the present work, Gilding, Parting, Purifying, Refining, Smithery, &c. are treated under their proper names. With others, therefore we have chosen to restrain *Metallurgy* to those operations required to separate metals from their ores for the uses of life. These operations are of two kinds: the smaller, or Essaying; and the larger, or Smelting. But a particular description of the ores themselves seemed likewise necessary to be given; and to this place, too, we have referred a general account of metals, metallisation, mines, and ores, as a proper introduction to the subject. Hence the following division into three parts. The *first* treating; 1. Of metals and metallisation. 2. Of mines and ores in general. 3. Of the pyrites. 4. Of the essaying of ores in general. The *second*, Of the particular ores, and the methods of essaying them. The *third*, Of smelting of ores, or the methods of extracting metals from large quantities of ores for the purposes of commerce or manufacture.

PART I.

SECT. I. *Of Metals and Metallisation.*

UNDER the general name *metal*, we comprehend here not only the metals properly so called, but also the *semimetals*, or all matters which have the essential metallic properties which we shall here recount. Thus the word *metal* and *metallic substance* will be synonymous in this article.

Metallic substances form a class of bodies, not very numerous, of very great importance in chemistry, medicine, arts, and the ordinary affairs of life. These substances have very peculiar properties, by which they differ from all other bodies.

The natural bodies from which metals differ the least are, earthy and pyritous matters, on account of their solidity and density. Metals and stones are, nevertheless, very different; the heaviest stones which are unmetallic being much lighter than the lightest metals. A cubic foot of marble weighs 252 pounds; and an equal bulk of tin, the lightest of metals, weighs 516 pounds. The difference is much greater when the weight of such stone is compared with that of gold, a cubic foot of which is 1326 pounds.

Opacity is another quality which metals possess eminently, the opacity of metals being much greater than that of any unmetallic substance.

This great opacity of metals is a consequence of their density; and these two properties produce a third, peculiar also to metals, namely, a capacity of reflecting much more light than any other body: hence metals whose surfaces are polished, form mirrors representing the images of bodies more clearly than any other matter. Thus looking-glasses produce their reflection merely by the silvering, which is a covering of metal upon their surfaces. To this reflective property metals owe their peculiar lustre, called the *metallic lustre*.

Although the several metallic substances differ considerably in hardness and fusibility, we may say in general, that they are less hard and less fusible than pure earths.

Metals cannot unite with any earthy substance, not even with their own earths, when these are deprived of their metallic state: hence, when they are melted, they naturally run into globes, as much as the absolute gravity of their mass, and their pressure upon the containing vessels, will allow. Accordingly, the surface of a metal in fusion is always convex. A metal in that state always endeavours to acquire a spherical form, which it does more perfectly as the mass is less. This effect is very sensible in quicksilver, which is nothing but a metal habitually fluid or fused. A mass of several pounds of mercury, contained in a shallow wide-mouthed vessel, is so spread out, that its upper surface is almost flat, and the convexity is not very sensible but at its circumference; on the contrary, if we put very small masses of mercury into the same vessel, as, for instance, masses weighing a grain each, they become so round as to seem perfect globes. This effect is partly occasioned by the inapitude of metals to unite with the vessels containing them when in fusion, by which quality the whole affinity which subsists betwixt the integrant parts of these metals is capable of acting; and partly also by this affinity, which disposes the integrant parts to come as near to each other as they can, and consequently to form a sphere.

This property is not peculiar to melted metals, but to all fluids, when contiguous to bodies solid or fluid, with which they have no tendency to unite. Thus, for instance, masses of water upon oily bodies, or oily masses upon bodies moistened with water, assume always a form so much nearer to the spherical as they are smaller. Even a large drop of oil poured upon a watery liquor, so that it shall be surrounded with this liquor, becomes a perfect sphere.

All metals are in general soluble by all acids; but often these solutions require particular treatment and circumstances, which are mentioned under CHEMISTRY. With acids, they form a kind of neutral salts, which have

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have all more or less causticity. The affinity of metals is less than of absorbent earths and alkaline salts to acids; and therefore any metal may be separated from any acid by these substances.

Alkaline salts are capable of acting upon all metallic substances, and by proper management will keep them dissolved.

Metals may in general be united with sulphur and liver of sulphur. With sulphur they form compounds resembling the peculiar substance of ores, which are generally nothing else than natural combinations of sulphur and metal. Metals have less affinity with sulphur than with acids; hence sulphur may be separated from them by acids. Some exceptions from these general rules, concerning the affinity of metals to sulphur and liver of sulphur, and concerning their separation from sulphur by acids, may be seen under the articles of the several metals. But these exceptions do probably take place, only because we have not yet found the method of surmounting some obstacles which occur in the ordinary methods of treating certain metals.

All metals may in general be united with each other, with which they form different allays which have peculiar properties; but this rule also is not without some exceptions.

Metals have a strong affinity with the inflammable principle, and are capable of receiving it superabundantly.

Lastly, oily substances seem to be capable of acting upon all metals. Some metals are easily and copiously dissolved by oils; and perhaps they might all be found to be entirely soluble in oils, if the methods known in chemistry were tried for the accomplishment of these solutions.

The properties abovementioned agree in general to all metallic substances: but, besides the properties peculiar to each metal, some properties are common to a certain number of them; and hence they have been divided into several classes.

Those metallic matters which, when struck by a hammer, or strongly compressed, are extended, lengthened, and flattened, without being broken (which property is called *ductility* or *malleability*), and which also remain fixed in the most violent and long continued fire, without diminution of weight, or other sensible alteration, are called *perfect metals*. These perfect metals are three; *gold, silver, platina*.

The metallic matters which are ductile and fixed in the fire to a certain degree, but which are destroyed by the continued action of fire, that is, changed into an earth deprived of all the characteristic properties of metals, are called *imperfect metals*. Of this kind are four; *copper, iron, tin, lead*.

The metallic substances which, as well as the imperfect metals, lose their metallic properties by exposure to fire, but which also have no ductility or fixity, are distinguished from the others by the name of *semimetals*. Of this class are seven; *regulus of antimony, bismuth, zinc, nickel, regulus of cobalt, regulus of arsenic*, and of *manganese*.

Lastly, *mercury*, which has all the general properties of metals, makes a class separate from the others; because in purity and gravity it is similar to the perfect metals, and in volatility to the semi metals. Its fusibility also so far surpasses that of any other metallic matter, that it is not sufficient to distinguish it from all, and to give it a distinct class. We have enumerated, therefore, in all, 15 metallic substances; four of which were unknown to the ancients, namely, platina, regulus of cobalt, of manganese, and nickel.

As chemists can compound bodies by being capable of separating the principles of such bodies, and even of reuniting their principles so as to reproduce such compounds as they were originally; and as hitherto they have not been able to accomplish any such decomposition upon the perfect metals: hence, if all the other metallic substances were equally unalterable, we should be very far from having certain notions concerning metals in general: but if we except gold, silver, and platina, all the other metallic matters are susceptible of decomposition and of recomposition, at least to a certain degree; and experiments of this kind have thrown much light on the subject.

We may observe, that even if we had not been able to decompose any metallic substance, we might still, by reflecting on the essential properties of metals, discover sufficiently well the nature of their principles.

The solidity, the consistence, and especially the gravity, which they possess in a degree so superior to all other bodies, would not have allowed us to doubt that the earthy element, of which these are the characteristical properties, enters largely into their composition, and makes their basis.

The facility with which they combine with almost all inflammable matters, and with all those which have great affinity with phlogiston, such as acids; joined to their incapacity of being allayed with meagre matters that are purely earthy or purely watery, which have no disposition to unite with phlogiston; would also have furnished very strong motives to believe, that the inflammable principle enters largely into the composition of metals.

The destructible metals present exactly the same phenomena as all other bodies containing the inflammable principle do, in the state of combustion. When exposed to fire, without access of air, that is, in close vessels, they become red-hot, melt, or sublime, according to their nature: but they receive no alteration in their composition from fire applied in this manner, and they are afterwards found to be exactly in the same state as before. In this respect, they resemble perfectly all bodies which contain no other inflammable matter than pure phlogiston.

But when imperfect metals are exposed to fire, with access of air, as, for instance, under a muffle in a furnace which is made very hot, then they burn more or less sensibly, as their inflammable principle is more or less abundant, or more or less combined. Some of them, as iron and zinc, burn with a very lively and brilliant flame; but this flame is of the same nature as that of charcoal, of sulphur, of all bodies, the combustible principle of which is pure phlogiston, and is not in an oily state, that is, furnishes no soot capable of blackening.

The imperfect metals detonate with nitre, and their phlogiston is consumed by this method much more

more quickly and completely than by ordinary calcination or combustion. Their flame is also much more lively and brilliant: and some of them, as iron and zinc, are used in compositions for fireworks from their very vivid and beautiful flame.

Nitre is alkalised by these metallic detonations exactly in the same manner as in its detonation by coals.

Lastly, imperfect metals being treated with acids which have an affinity with phlogiston, that is, with the vitriolic and nitrious acids, and deprived by these acids of a more or less considerable part of their inflammable principle; they give a sulphureous quality to vitriolic acid, and are even capable of producing sulphur with that acid.

Although the experiments now mentioned were the only proofs of the existence of an inflammable principle in metallic substances, they would be sufficient to establish it incontestably. But we shall see, when we continue to examine the phenomena attending the decomposition of metals, that those are not the only proofs.

If the inflammable matter which shows itself so evidently in the burning of metals, is really one of their constituent parts, their essential properties must be altered in proportion to the quantity of it taken from them: and this evidently happens upon trial: for the residuum of metallic matters, after calcination, departs from the metallic character, and approaches to the nature of mere earth. The opacity, brilliancy, ductility, gravity, fusibility, volatility, in a word, all the properties by which metallic substances differ from simple earths, diminish or entirely disappear, by taking from them their inflammable principle; so that when their calcination has been carried as far as is possible, they resemble mere earths, and have no longer any thing in common with metals. These earths can no longer be combined with acids or with metals, but are capable of uniting with pure earths. They are then called *calxes* or *metallic earths*. See CHEMISTRY.

We must observe concerning the decomposition of metals, 1. That when a small quantity of inflammable principle is taken from metal, only a small quantity of calx is formed, and the remaining part continues in the metallic state: hence, as the portion of calcined matter can no longer remain united with that which is destroyed, it separates in form of scales from the surface of the metal when the calcination has been performed without fusion, as generally happens to iron and to copper: or these scales float upon the surface of the melted matter when the calcination is performed during fusion, because the calx is specifically lighter than the metal; as happens to the very fusible metals, as tin, lead, and most of the semimetals.

2. The imperfect metals are not all equally easily and completely calcinable. In general, as much of their phlogiston may be easily taken from them, as is sufficient to deprive them of their metallic properties; but the remaining portion of their phlogiston cannot be so easily driven off. Some of them, as copper, resist the first calcination more than the rest; and others, as lead and bismuth, may be very easily calcined, but only to a certain degree, and retain always obstinately the last portions of their inflammable principle; lastly others, as tin and regulus of antimony, may not only be easily and quickly calcined, but also much more completely. All the other metals partake more or less of the properties relating to their calcination. In general, if we except the labours of alchemists, which are not much to be depended upon, we have not yet made all the proper efforts to arrive at a perfect calcination of the several metallic substances; which however is absolutely necessary, before we can arrive at a complete knowledge of the nature of their earths, as we shall afterwards see.

When metallic earths have lost but little of their phlogiston, and are exposed to strong fire, they melt, and are reduced to compact masses, still heavy and opake; although much less so than the metals, and always brittle and absolutely unmalleable. If the calcination has been more perfect, the metallic earths are still fusible by fire, but less easily, and covertible into brittle and transparent masses possessed of all the properties of glass, and are accordingly called *metallic glasses*. These glasses do not possess any of the properties of their metals, excepting that they are specifically heavier than other glasses, that they are capable of being attacked by acids, and that the glasses of the semimetals are somewhat less fixed than unmetallic glasses. Lastly, when the calcination of metals has been carried to its greatest height, their earths are absolutely fixed, and unfusible in the fire of our furnaces, and possess no longer the solubility in acids by which metals are characterised.

These are the principal changes which metals suffer by losing their phlogiston. They are thus changed into substances which have no properties but those of earth. This is a certain proof that the inflammable principle is one of their constituent parts. But we have also other proofs of this important truth. The reduction of metallic calxes into metal, by the addition of phlogiston alone, completes the proof; and the whole forms one of the clearest and most satisfactory demonstrations in all the sciences. This reduction is effected in the following manner:

If the earth of a metal be mixed with any inflammable matter, which either is or can be changed into the state of coal, together with some salt capable of facilitating fusion, but which, from its quantity or quality, is incapable of receiving the inflammable principle; and if the whole be put into a crucible, and the fusion promoted by a fire gradually raised; than an effervescence will happen, accompanied with a hissing noise, which continues a certain time, during which the fire is not to be increased; afterwards, when the whole has been well fused, and the crucible taken from the fire and cooled, we shall find at the bottom, upon breaking it, the metal, the earth of which was employed for the operation, possessed of all the properties which it had before calcination and reduction.

We cannot doubt that this transformation of an earthy substance into a metal, is solely caused by the phlogiston passing from the inflammable matter to the metallic earth. For, first, in whatever manner and with whatever substance metallic earths be treated, they cannot be ever reduced into metals without a concurrence of some substance containing phlogiston. 2dly, The nature of the substance which is to furnish phlogiston is quite indifferent, because this principle is the same in all bodies containing it. 3dly, If, after the

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the operation, the substance furnishing the phlogiston be examined, we shall find that it has lost as much of that principle as the metallic earth has received. See PHLOGISTON.

The facts related concerning the decomposition and the recomposition of metals, prove incontestably that they are all composed of earth and phlogiston. But we do not yet certainly know whether these two be the only principles of metals. We might affirm this, if we could produce metals by combining phlogiston with some matter which is certainly known to be simple earth. But this hitherto has not been accomplished; for if we try to treat any earth, which has never been metallic, with inflammable matters, we shall perceive that the simple earths are not combinable with phlogiston so as to form metals. We shall even perceive that the metallic earths resist this combination, and are incapable of reduction into metal, when they have been so much calcined as very nearly to approximate the nature of simple earths.

These considerations, added to this, that we cannot easily conceive how, from only two certain principles, so many very different compounds as the several metallic substances are, should result, are capable of inducing a belief that some other principle is added to these two already mentioned in the composition of metals.

Many great chemists, and particularly Becher and Stahl, seem to be of this opinion. Chiefly from the experiments concerning the mercurification of metals, they believe that this third principle exists copiously in mercury; that it is of a mercurial nature; that it also exists in marine acid, to which it gives its specific character; that, by extracting this mercurial principle from marine acid, or any other body containing it copiously, and by combining it with simple earths, these may acquire a metallic character, and be rendered capable of receiving phlogiston, and of being completely metallised.

These chemists admit also, and with probability, a different proportion of metallic principles in the several metals; and believe, that particularly the principle which they call *mercurial earth*, exists more copiously and sensibly in certain metals than in others. The most mercurial metals, according to them, are mercury, silver, lead, and arsenic. Most chemists distinguish them from the other metals, which they call *white metals*, *lunar metals*, or *mercurial metals*.

All these considerations being united, and others too many to be mentioned, give some probability to the existence of the mercurial principle in metals. We must however acknowledge, that the existence of this principle is merely probable; and, as Stahl observes, is not nearly so well demonstrated as that of the inflammable principle: we may even add, that we have strong motives to doubt of its existence.

To produce metals artificially has justly been reckoned one of the most difficult problems in chemistry.

Metallic substances, although they resemble each other by their general properties, differ nevertheless from each other very evidently by the properties peculiar to each. Do these differences proceed from the different proportion, and from the more or less intimate connection of the inflammable principle with the earthy principle, supposing that this latter should be essentially the same in all metals? or ought they to be attributed to the difference of earths, which in that case would be distinct and peculiar to each metal? or, lastly, do metals differ from each other, both by the nature of their earths, and by the proportion and intimacy of connection of their principles? All these things are entirely unknown; and we may easily perceive, that till they are known, we cannot discover what method to pursue in our attempts to accomplish the combinations we are now treating of.

The most essential point then is, to arrive at a knowledge of the true nature of the earths which are in metals; and the only method of arriving at this knowledge is, by reducing them to their greatest simplicity by a perfect calcination. But this cannot be accomplished but by long and difficult operations. We have seen above, that all metals are not calcinable with equal ease; that the perfect metals have not been hitherto calcined truly by any process; and that, in general, the last portions of phlogiston adhere very strongly to calcinable-metals.

Some metals, however, as tin and regulus of antimony, may be easily calcined so as to be rendered irreducible. By carrying the calcination still further, we might obtain their earths so pure, that all their essential properties may be discovered, by which they might be easily compared together. This comparison would decide whether their nature be essentially different or not.

If they were found to be composed of earths essentially the same, we might next proceed to compare metallic with unmetallic earths. If the former were found similar to some of the latter kind, we should be then assured that the earth of metals is not peculiar to them, and that ordinary unmetallic earths are susceptible of metallisation. From some late experiments, it was imagined that lime and magnesia alba were capable of being converted into metallic substances, but the processes are now found to be erroneous.

The greater the number of metals operated upon, the more general and certain the consequences resulting from these would be: so that, for instance, if the operation were extended to all calcinable metals; and if the result of each of these operations were, that the calxes, when perfectly dephlogisticated, do not differ from each other, and are similar to earths already known; we might conclude from analogy, and we should be almost certain, that the earths of the perfect metals are also of the same nature.

They who know the extent and difficulties of chemical operations, will easily perceive that this would be one of the most considerable. Nevertheless, after having determined this essential point, we should only have done half our work: For a knowledge of the nature of the earth of metals, and where it is to be found, would not be sufficient; we must further endeavour to find a method of combining with this earth a sufficient quantity of phlogiston, and in a manner sufficiently intimate, that a metal might be formed by such a combination. But this second difficulty is perhaps greater than the former.

We must observe here, that some famous chemical processes have been considered by many as metallisations, but which are really not so. Such is Becher's famous experiment of the *minera arenaria perpetua*, by which that chemist proposed to the States-General to extract gold from any kind of sand. Such also is the process of Becher and of Geoffroy, to obtain iron

from

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from all clays by treating them with linseed oil in close vessels. In these, and many other such processes, we only obtain metal that was already formed. Every earth and sand, as the intelligent and judicious Cramer observes, contains some particles of gold. Clays do not commonly contain iron ready formed; but all of them contain a ferruginous earth, naturally disposed to metallisation. (See CLAY.) Accordingly we must conclude, that, by Mr Geoffroy's experiment, iron is only reduced or revived, but is not produced.

The great difficulties which occur in attempting to give a metallic quality to simple earths have induced a belief, that the nature of metals ready formed might be more easily changed, and the less perfect brought to a more perfect state. To effect this, which is one of the principal objects of alchemy, and is called *transmutation*, numberless trials have been made. As we have not any certain knowledge of what occasions the specific differences of metallic substances, we cannot decide whether transmutation be possible or not. In fact, if each metallic substance have its peculiar earth, essentially different from the earths of the others, and consequently if the differences of metals proceed from the differences of their earths; then, as we cannot change the essential properties of any simple substance, transmutation of metals must be impossible. But if the earths and other principles of metals be essentially the same, if they be combined in different proportions only, and more or less strictly united, and if this be the only cause of the specific difference of metals; we then see no impossibility in their transmutation.

Whatever be the cause of the differences of metals, their transmutation seems to be no less difficult than the production of a new metallic substance; and perhaps it is even more difficult. Alchemists believe that transmutation is possible, and they even affirm that they have effected it. They begin by supposing that all metals are composed of the same principles; and that the imperfect metals do not differ from gold and silver, but because their principles are not so well combined, or because they contain heterogeneous matters. We have then only these two faults to remedy, which, as they say, may be done by a proper coction, and by separating the pure from the impure. As we have but very vague and superficial notions concerning the causes of the differences of metals, we confess that we cannot make any reasonable conjecture upon this matter; and we shall only advise those who would proceed upon good principles, to determine previously, if metals have each a peculiar earth, or only one common to them all. In the second place, if it should be demonstrated that the earthy principle is the same in all metals, and if that be demonstrated as clearly as the identity of the inflammable principle in metals is proved; they must then determine whether these two be the only principles in metals, whether the mercurial principle exists, and whether it be essential to all metals or to some only, and what is the proportion of those two or three principles in the several metallic substances. When we shall clearly understand these principal objects, we may then be able to determine concerning the possibility of transmutation; and if the possibility should be affirmed, we shall then begin to discover the road which we ought to pursue.

We have no reason to believe that any other principle enters into the composition of metals than those abovementioned: no vestige is perceptible of either air or water. Some chemists have nevertheless advanced that they contain a saline principle. If that were true, they would also contain a watery principle. But all the experiments adduced to prove this opinion are either false, or only show the presence of some saline particles extraneous to the metals, or contained unknown to the chemists in the substances employed in the experiments. For metals perfectly pure, subjected to all trials with substances which do not contain and which cannot produce any thing saline, do not discover any saline property. We must however except arsenic, and even its regulus, these being singular substances, in which the saline are as sensible as the metallic properties.

Arsenic seems to be one of those intermediate substances which nature has placed in almost all its productions betwixt two different kinds, and which partake of the properties of each kind. Arsenic thus placed betwixt metallic and saline substances has properties common to both these kinds of substances, without being either entirely a metal or salt. See ARSENIC.

As water seems to act to a certain degree upon iron, even without the concurrence of air, as the operation of *martial ethiops* shows, we might thence suspect something saline in that metal. Nevertheless, what happens in that operation has not been so well explained, that any certain consequences can be deduced. 1. The water employed ought to be perfectly pure; that is, distilled rain-water. 2. The iron employed ought also to be perfectly pure, and such is very difficultly to be procured. 3. The operation ought to be performed in a bottle accurately closed, that we may be assured that the air contributes nothing to the action upon the iron. 4. After the water has remained a long time, suppose a year, upon the iron, it ought to be carefully filtrated and examined, to ascertain whether it really has dissolved any part of the metal.

In the mean time, we may conclude that metals do not seem to contain any saline principle. And when we consider well their general properties, they seem to be nothing else than earths combined more or less intimately with a large quantity of phlogiston. Although we can demonstrate that their inflammable principle is not in an oily state, and that it is pure phlogiston, they have nevertheless an oily appearance, in this circumstance, that they adhere no more than oils to earthy and aqueous substances and that they always assume a globular figure when supported by these substances entirely free from phlogiston.

This resemblance is so sensible, that chemists, before they knew the nature of phlogiston, believed that metals contained an oily and fat matter. The cause of this quality of metals is the quantity of phlogiston which they contain. Sulphur, phosphorus, oils, and even fats, have this appearance merely from the inflammable principle which enters into their composition: for this property is communicated by that principle to every compound which contains a certain quantity of it. See PHLOGISTON.

When the phlogiston combines copiously and intimately with earthy matters so as to form metals, it probably

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probably so disposes them, that the primitive integrant parts of the new compound, that is, of the metal, approximate and touch each other much more than the integrant parts of simple earths can. This is proved by the great density or specific gravity, and other general properties, of metals.

In fact, as we cannot conceive that a body should be transparent, unless it have pores and interstices through which rays of light can pass; therefore the more dense a body is, that is, the fewer such interstices it has, the less transparent it will be; so that the densest bodies ought to be the most opaque as in metals. The disposition of the pores of bodies contributes also much to their greater or less transparency; and bodies, the pores of which are continued and straight, are more transparent than those whose pores are interrupted, transverse, or oblique; so that a body may be much more transparent than another which is less dense, as we see that glass is more transparent than charcoal. But when other circumstances are equal, the densest bodies are the most opaque. Therefore the opacity of bodies is proportionable to their density, and to the deviation of their pores from right and parallel lines.

From the great opacity of metals, they probably possess both these qualities in an eminent degree. We have seen, at the beginning of this article, that the lustre of metals, and their property of reflecting light much better than any other substance, are necessary consequences of their opacity. This is also self-evident, because the fewer rays any body can transmit, the more it must reflect.

Lastly, the ductility of metals proceeds also from their density, from the disposition of their pores, and from the action of latent heat; for even the most brittle bodies, such as glass, sealing-wax, &c. become ductile by heat. The softness, fusibility, and volatility, of which all metals partake more or less, and which many of them possess in a superior degree, being properties entirely contrary to those of the earthy principle, probably proceed from the inflammable principle.

The order in which metals compared with each other possess most eminently their principal properties, is the same as that in which they are here enumerated, beginning always with that metal in which the property is most considerable.

1. *Specific gravity* or *density*. Platina, gold, mercury, lead, silver, copper, iron, and tin.

2. *Opacity*. We cannot well compare metals with each other in this respect, because it is so considerable in all, that it seems complete. If, however, they differ in this respect, the same order will serve for opacity as for density.

3. *Metallic lustre* or *brilliancy*. The same observation which was made concerning the last mentioned property is applicable to this also. We must, however, observe, that as by polish bodies are rendered brighter, and that as whiteness contributes much to the reflection of light, the whitest and hardest metals therefore reflect best. Hence according to Mr Macquer, platina ought to be placed first; and then iron, or rather steel, silver, gold, copper, tin, lead.

Hardness of metals may contribute much to the duration of their polish; but certainly soft metals, if their texture be equally compact, are no less capable of receiving a polish than hard metals. Some hard metallic allays have been found to be less liable to tarnish than softer compounds, and have for this reason also been chiefly used for speculums. The property of reflecting light seems chiefly to depend on the closeness of the particles or on the density, on the smoothness of the surface, and on the colour being most similar to the colour of the light to be reflected. The white metals, silver, mercury, tin, reflect light more abundantly than others. Gold, being the densest metal next to platina, and perhaps because the colour of solar light has a slightly yellowish tinge, does also reflect light very copiously. Hence speculums made of leaf-gold have been found to be very powerful. Iron or steel reflects much less light than any of the abovementioned metals, although Mr Macquer has considered it as capable of a greater reflective power. Platina is generally in so small grains, that its reflective power cannot easily be determined. The precise degrees of that power which ought to be assigned to each of the abovementioned metals, cannot without accurate experiments be ascertained. Perhaps, however, their reflective powers will be found to be more nearly in the following order, than in that abovementioned from Mr Macquer. Silver, quicksilver, tin, gold, copper, iron, lead.

4. *Ductility*. Gold, silver, copper, iron, tin, lead. The ductility of mercury and that of platina are not yet determined.

5. *Hardness*. Iron, platina, copper, silver, gold, tin, and lead.

6. *Tenacity*. By tenacity we understand the force with which the integrant parts of metals resist their separation. This force appears to be in a compound ratio of their ductility and hardness. The comparative tenacity of metals is measured by the weight which wires of the same diameter, made of the several metals, can sustain without breaking. Gold is the most tenacious; then iron, copper, silver, tin, lead. The tenacity of mercury is unknown; that of platina is not yet determined, but is probably considerable.

7. *Fusibility*. Mercury, tin, lead, silver, gold, copper, iron, and lastly platina, which cannot be fused by the greatest fire of our furnaces, but only by the solar focus, or by a fire excited by dephlogisticated air.

Sect. II. *Of Mines and Ores in general.*

The substances found naturally combined with metals in the earth, are, particularly sulphur and arsenic, sometimes separately, but generally conjointly. Metals combined with these substances are called *metals mineralised by sulphur*, or *by arsenic*, or *by sulphur and arsenic*; and these matters are called *mineralising* substances.

Besides the sulphur and arsenic with which metals are strictly combined in the mineral state, they are also pretty intimately combined with earthy substances, of different natures, and more or less divided.

These different matters united together form masses which are compact, heavy, brittle, and frequently possessed of much metallic lustre. These substances are properly called *ores*, or the matter of mines.

Of Mines and Ores.

These ores are found in earths and stones of different kinds, as sands, flints, crystals, slates, indurated clays, according to the ground in which they are contained. But two kinds of stones in particular seem to accompany ores; and have therefore been considered by several mineralogists as matrixes in which metals are formed. One of these stones is a kind of crystal, generally white, milky, and semi-opaque, striking fire with steel, and of the class of vitrifiable earths. It is called QUARTZ.

The other stone is less hard, which does not strike fire with steel, and is sometimes milky like quartz; sometimes transparent and of different colours; consisting of rhomboidal crystals, which are composed of plates and faces. This stone becomes more soft and friable by being exposed to fire. It is called *spar*. Spar is more like to gypseous stones than to any other, but it differs from gypseous stones in possessing a much greater density. Some spars are so heavy, that they exceed in this respect all other stones. See SPAR.

These earthy and stony substances form the *matrix of the ore*.

Ores are natural compounds, containing metals allayed with different substances.

Excepting gold, and a very small quantity of each of the other metals found in some places so pure as to possess all their characteristic properties, nature exhibits to us metals and semimetals differently allayed not only with each other, but also with several heterogeneous substances, which so alter and disguise their qualities, that in this state they cannot serve for any of the purposes for which they are proper when they are sufficiently pure.

Ores consist, 1. Of metallic substances *calcined*; or, 2. Of these substances combined with other matters, with which they are said to be *mineralised*.

Calcined metallic substances, or *calciform ores*, are metallic substances deprived of phlogiston, and in the state of a calx or metallic earth. Such are all *ferruginous ochres*, which are calces of iron.

Mineralised ores, are, 1. *Simple*, containing only one metallic substance; or, 2. *Compound*, containing two or more metallic substances.

Of the simple, and also of the compound ores, four kinds may be distinguished.

1. Ores consisting of metallic substances mineralised by *sulphur*. Such is the lead-ore called *galena*, composed of lead and sulphur.

2. Ores consisting of metallic substances mineralised by *arsenic*. Such is the *white pyrites*, containing iron and arsenic.

3. Ores consisting of metallic substances mineralised *by sulphur and by arsenic*. Such is the *red silver-ore*, containing silver, arsenic, and sulphur.

4. Ores consisting of metallic substances mineralised by *saline matters*. Such are the *native vitriols*. Such also is probably the *corneous silver-ore*, which, according to Mr Cronstedt's opinion, is a luna cornea, or silver combined with marine acid. Of this kind of ores, or native metallic salts, is perhaps the *sedative salt of borax*, which from Mr Cadet's experiments, published in the Memoirs of the Royal Academy for the year 1766, is conjectured to be copper combined with marine acid, and which has been said to be found native. To this class also may be referred the *silver mineralised by an alkaline substance*, which Mr Von Justi pretends to have discovered.

Henckel, and after him Cramer, and the author of the Dictionary of Chemistry, pretend, that in mineralised ores, besides the abovementioned metallic and mineralising substances, are also contained a metallic and an unmetallic earth. But Wallerius affirms, that the existence of such earths cannot be shown, and that sulphur is incapable of dissolving unmetallic earths, and even the calces of all metallic substances, excepting those of lead, bismuth, and nickel.

Metals and *metalliferous ores* are found in various places.

I. *Under water*; in beds of rivers, lakes, and seas, and chiefly at the flexures of these: such are the auriferous and ferrugineous sands, grains of native gold, ochres, and fragments of ores washed from mines.

II. *Dissolved in water*: such are the vitriolic waters containing iron, copper, or zinc.

III. *Upon the surface of the earth*. Such are many ochres; metalliferous stones, sands, and clays; and lumps of ores. Mr Gmelin says, that in the northern parts of Asia ores are almost always found upon or near the surface of the ground.

IV. *Under the surface of the earth*. When the quantity of these collected in one place is considerable, it is called a *mine*.

Subterranean metals and ores are differently disposed in different places.

1. Some are *infixed in stones and earths*, forming *nodules* or *spots* diversely coloured.

2. Some are equably and *uniformly diffused through the substance of earths and stones*, to which they give colour, density, and other properties. Such are the greatest part of those earths, stones, sands, clays, crystals, flints, gems, and fluors, which are coloured.

3. Some form *strata* in mountains. Such are the slates containing pyrites, copper-ore, lead-ore, silver-ore, or blend. These lie in the same direction as the strata of stones betwixt which they are placed; but they differ from the ordinary strata in this circumstance, that the thickness of different parts of the same metalliferous stratum is often very various; whereas the thickness of the stony strata is known to be generally very uniform.

4. *Fragments of ores* are frequently found accumulated in certain subterranean cavities, in fissures of mountains, or interposed betwixt the strata of the earth. These are loose, unconnected, frequently involved in clay, and not accreted to the contiguous rocks or strata immediately, nor by intervention of spar or of quartz, as the ores found in veins are. Tin and iron mines are frequently of the kind here described.

5. Large entire masses of ores sometimes found in the stony strata of mountains. These are improperly called *accumulated veins*, because their length, relatively to their breadth and depth, is not considerable.

6. Some instances are mentioned of *entire mountains* consisting of ore. Such is the mountain Taberg in Smoland; and such are the mountains of Kerunavara and Luosavara in Lapland, the former of which is 1400 perches long and 100 perches broad. These mountains consist of iron-ore.

7. Lastly, and chiefly, metals and ores are found in oblong

Of Pyrites. oblong tracts, forming masses called *veins*, which lie in the stony strata composing mountains. See the article MINE.

SECT. III. *Of the Pyrites.*

PYRITE is a mineral resembling the true ores of metals, in the substances of which it is composed, in its colour or lustre, in its great weight, and, lastly, in the parts of the earth in which it is found, since it almost always accompanies ores. It is, like ores, composed of metallic substances, mineralized by sulphur or by arsenic, or by both these matters, and of an unmetallic earth intimately united with its other principles.

Notwithstanding the conformity of pyrites with ores properly so called, some chemists and metallurgists distinguish the former from the latter minerals; because the proportion and connection of the materials composing the pyrites differ much from those of ores. Thus, although sometimes pyrites contains more metal than some ores, yet generally it contains less metal, and a larger quantity of mineralising substances, sulphur and arsenic, and particularly of unmetallic earth. The connection of these matters is also much stronger in pyrites than in ores, and they are accordingly much harder; so that almost every pyrites can strike sparks from steel.

From the above property of striking sparks from steel, they have been called *pyrites;* which is a Greek word signifying *fire-stone*. Pyrites was formerly used for fire-arms, as we now use flints: hence it was called *carabine-stone*. It is still named by some, *marcasite*. Perhaps no other kind of natural body has received so many names. Persons curious to know the other names less used than those we have mentioned, may find them in *Henckle's Pyritologia*. We think, with that celebrated chemist, that the subject has been perplexed by this multiplicity of names; for before his great and excellent work, the notions concerning pyrites were very confused and inaccurate.

Pyrite differs also from ores by its forms and positions in the earth. Although pyritous metals generally precede, accompany, and follow veins of ores; they do not, properly speaking, themselves form the oblong and continued masses called *veins*, as ores do; but they form masses sometimes greater and sometimes smaller, but always distinct from each other. Large quantities of them are often found unaccompanied by ores. They are formed in clays, chalk, marles, marbles, plasters, alabasters, slates, spars, quartz, granites, crystals, in a word, in all earths and stones. Many of them are also found in pit-coals and other bituminous matters.

Pyrites is also distinguishable from ores by its lustre and figure; which is almost always regular and uniform, externally or internally, or both. Some ores indeed, like those of lead, many ores of silver, and some others, have regular forms, and are in some manner crystallized; but this regularity of form is not so universal and so conspicuous in ores as in pyrites. The lustre of pyrites seems to be caused by its hardness, and the regularity of its form by the quantity of mineralising substances which it contains.

By all these marks we may easily, and without analysis, distinguish pyrites from true ores. When we see a mineral that is heavy, possessed of metallic lustre, and of any regular form, the mass of which appears evidently to be entire, that is, not to have been a fragment of another mass, and which is so hard as to be capable of striking sparks from steel, we may be assured that such a mineral is a pyrites, and not an ore.

The class of pyrites is very numerous, various, and extensive. They differ one from another in the nature and proportions of their component parts, in their forms, and in their colours. The forms of these minerals are exceedingly various. No solid, regular or irregular, can easily be conceived, that is not perfectly imitated by some kind of pyrites. They are spherical, oval, cylindrical, pyramidal, prismatical, cubic; they are solids with 5, 6, 7, 8, 9, 10, &c. sides. The surface of some is angular, and consists of many bases of small pyramids; while their substance is composed of these pyramids, the points of which all unite in the centre of the mass.

Pyritous minerals differ also in their component substances. Some of them are called *sulphureous*, *martial*, *cupreous*, *arsenical*, as one or other of these substances predominate. We must observe with Henckel, whose authority is very great in this subject, that in general all pyrites are martial; as ferruginous earth is the essential and fundamental part of every pyrites. This earth is united with an unmetallic earth, with sulphur or arsenic, or with both these matters; in which case, the sulphur always predominates over the arsenic, as Henckel observes. He considers these as the only essential principles of pyrites; and believes that all the other matters, metallic or unmetallic, which are found in it, are only accidental; amongst which he even includes copper, although so much of it exists in some kinds of pyrites, that these are treated as ores of copper, and sometimes contain even 50lb. of copper each quintal. Many other metals, even gold and silver, are sometimes combined in pyrites; but these are less frequent, and the precious metals always in very small quantities; they are therefore justly to be considered as accidental to pyrites. The different substances composing pyrites sensibly affect its colours. Henckel distinguishes them in general into three colours, white, yellowish, or a pale yellow, and yellow. He informs us, that these three colours are often so blended one with another, that they cannot be easily distinguished unless when compared together.

The white pyrites contain most arsenic, and are similar to cobalt and other minerals abounding in arsenic. The Germans call them *mispickle*, or *mispilt*. Iron and arsenic form the greatest part of this pyrites. As arsenic has the property of whitening copper; some pyritous minerals almost white, like that of Chemnitz in Misnia, are found to contain 40 pounds of copper per quintal, and which are so much whitened by the arsenic, that they are very like white pyrites. But Henckel observes, that these pyritous matters are very rare, and are never so white as the true white pyrites, which is only ferruginous and arsenical.

Yellowish pyrites is chiefly composed of sulphur and iron. Very little copper and arsenic are mixed with any pyrites of this colour, and most of them contain none of these two metallic substances. This is the most common kind of pyrites: it is to be found almost every where. Its forms are chiefly round, spherical, oval, flattened, cylindrical; and it is composed internally of needles

needles or radii, which unite in the centre, or in the axis of the solid.

Yellow pyrites receives its colour from the copper and sulphur which enter into its composition. Its colour, however, is inclined to a green; but is sufficiently yellow to distinguish it from the other two kinds of pyrites, particularly when they are compared together. To make this comparison well, the pyrites must be broken, and the internal surfaces must be placed near each other. The reason of this precaution is, that the colour of minerals is altered by exposure to the air.

Persons accustomed to those minerals can easily distinguish them. The chief difficulty is, to distinguish white pyrites from cobalt and other minerals; which also contain some copper and much arsenic.

Hence then we see, that arsenic is the cause of whiteness in pyrites, and is obtained in every pyrites of that colour; that copper is the principal cause of the yellow colour of pyrites; and that every pyrites which is evidently yellow contains copper; that sulphur and iron produce a pale-yellow colour, which is also produced by copper and arsenic; hence some difficulty may arise in distinguishing pyrites by its colours. We may also observe, that sulphur and arsenic, without any other substance, form a yellow compound, as we see from the example of orpiment or yellow arsenic. Thus, although the colours of the pyrites enable us to distinguish its different kinds, and to know their nature at first sight, particularly when we have been accustomed to observe them; yet we cannot be entirely certain concerning the true nature of these minerals, and even of all minerals in general; that is to know precisely the kinds and proportions of their component substances, but by chemical analysis and decomposition.

Besides the abovementioned matters which compose pyrites, it also contains a considerable quantity of unmetallic earth; that is, an earth which cannot by any process be reduced to metal. Henckel, Cramer, and all those who have examined this matter, mention this earth, and prove its existence.

We ought to observe, that this earth is combined with the other principles of the pyrites, and not merely interposed betwixt its parts. It must therefore be distinguished from other earthy and stony matters mixed accidentally with pyrites, and which do not make a part of the pyrites, since they may be separated by mechanical means, and without decomposing that mineral: but the earth of which we now treat is intimately united with the other constituent parts of the pyrites, is even a constituent part of pyrites, and essential to the existence of this mineral, and cannot be separated but by a total decomposition of it.

According to Henckel, this unmetallic earth abounds much in the white pyrites, since he found from the analyses which he made, that the iron, which is the only metal existing in these pyrites, is only about $\frac{1}{25}$th part of the fixed substance that remains after the arsenic has been expelled by torrefaction or sublimation.

A much larger quantity of iron is in the pale yellow pyrites, according to Henckel. The proportion of iron is generally about 12 pounds to a quintal of pyrites, and sometimes 50 or 60 pounds: this is therefore called *martial pyrites*. It contains about one-fourth of its weight of sulphur, and the rest is unmetallic earth.

The quantity of unmetallic earth contained in the yellow or cupreous pyrites, which are also martial, since, as we have observed, iron is an essential part of every pyrites, has not yet been determined. They probably contain some of that earth, though perhaps less of it than the others.

The nature of this unmetallic earth of pyrites has not been well examined. Henckel thinks that it is an earth disposed already by nature to metallisation, but not sufficiently elaborated to be considered as a metallic earth. This opinion is not improbable; but as alum may be obtained from many pyrites, may we not suspect that this unmetallic earth is of the nature of the basis of alum or argillaceous earth? Perhaps also this earth is different in different kinds of pyrites. The subject deserves to be well examined.

Although pyrites are not so valuable as true ores, because in general it contains less metal, and but exceedingly little of the precious metals; and because its metallic contents are so difficult to be extracted, that, excepting cupreous pyrites, which is called *pyritous copper ore*, it is not worked for the sake of the contained metal; yet it is applied to other purposes, and furnishes us with many useful substances; for from it we obtain all our green and blue vitriols, much sulphur, arsenic, and orpiment. *See the principal processes by which these substances are extracted from pyrites, under the* section SMELTING *of* ORES.

As all pyrites contain iron, and most of them contain also sulphur; as the pyrites most frequently found contains only these two substances with the unmetallic earth; and as iron and sulphur have a singular action upon each other when they are well mixed together and moistened; hence many kinds of pyrites, particularly those which contain only the principles now mentioned, sustain a singular alteration, and even a total decomposition, when exposed during a certain time to the combined action of air and water. The moisture gradually penetrates them, divides and attenuates their parts; the acid of the sulphur particularly attacks the martial earth, and also the unmetallic earth; its inflammable principle is separated from it, and is dissipated. While these alterations happen, the pyrites changes its nature. The acid of the sulphur which is decomposed, forms with the fixed principles of the pyrites, vitriolic, aluminous, and selenitic salts; so that a pyrites, which was once a shining, compact, very hard mineral, becomes in a certain time a greyish, saline, powdery mass, the taste of which is saline, austere, and styptic.

Lastly, if this mass be lixiviated with water, crystals of vitriol, and sometimes of alum, according to the nature of the pyrites employed, may be obtained by evaporation and crystallization.

This alteration and spontaneous decomposition of pyrites, is called *efflorescence* and *vitriolization*; because the pyrites becomes covered with a saline powder, and because vitriol is always formed. This vitriolization is more or less quickly accomplished in pyrites according to its nature. It is a kind of fermentation excited by moisture amongst the constituent parts of these minerals; and it is so violent in those which are most dis-

posed

Of Pyrites.

posed to it, that is, in the pale yellow pyrites, which contain chiefly sulphur and iron, that when the quantity of these is considerable, not only a sulphureous vapour and heat may be perceived but also the whole kindles and burns intensely. The same phenomena are observable, and the same results are formed, by mixing well together, and moistening a large quantity of filings of iron and powdered sulphur; which experiment Lemeri has made to explain the causes of subterranean fires and volcanoes.

We cannot doubt that, as the earth contains very large masses of pyrites of this kind, they must undergo the same changes when air and moisture penetrate the cavities containing them; and the best natural philosophers agree, that very probably this surprising decomposition of pyrites is the cause of subterranean fires, of volcanoes, and of mineral waters, vitriolic, aluminous, sulphureous, hot and cold.

No other pyrites is subject to this spontaneous decomposition when exposed to humid air, but that which is both martial and sulphureous; that is, the pale-yellow pyrites. The arsenical pyrites, or that which contains little or no sulphur, is not changed by exposure to air. This latter kind is harder, heavier, and more compact than the former. The pyrites which is angular and regularly shaped, is chiefly of this kind. Mr Wallerius, in his Mineralogy, proposes to distinguish this kind of pyrites by the name of *marcasite*. When cut, it may be polished so well as to give a lustre almost equal to that of diamonds, but without refracting or decomposing the light; for it is perfectly opaque. It has been employed some years past in the manufacture of toys, as of buckles, necklaces, &c. and is called in commerce *marcasite*.

We cannot, however, concur with Mr Macquer (from whom the above is taken), in thinking that there is sufficient reason for considering the minerals called *pyrites*, as a distinct class of substances from ores. They have indeed no mark by which they can certainly and constantly be distinguished from these. The hardness or property of striking ignited sparks from steel is not common to all the substances generally called *pyrites*; for we find some of these enumerated by mineralogists which have not that property. Wallerius even mentions a pyrites which contains no iron, altho' that metal is thought by Henckel to be essential to pyrites. The distinction of pyrites from ores has been chiefly introduced by miners; because the greatest part of the former minerals contain so little metal, and so much of the mineralising substances, sulphur or arsenic, that they are seldom smelted. Nevertheless, some kinds of pyrites are found which contain so much copper, that they are smelted with great profit. Accordingly, some later mineralogists consider the cupreous yellow pyrites as an ore of copper, the pale-yellow martial pyrites as an ore of iron; aud the white arsenical pyrites as an ore of arsenic. See *Ores* of *Copper*, *Iron*, and of *Arsenic*, below.

Sect. IV. *Essaying of Ores in general.*

Essays are chemical operations made in small, to determine the quantity of metal or other matter which is contained in minerals; or to discover the value or purity of any mass of gold or silver. The former kind is the subject of the present section; the latter is treated under the word Essays, in the order of the alphabet.

Essaying of Ores.

Before essays of ores can be well made, a preliminary knowledge of the nature of the several metallic minerals ought to be attained. Each metal has its proper and improper ores, which have peculiar characters and appearances: hence persons accustomed to see them, know pretty nearly by the appearance, weight, and other obvious qualities, what metal is contained in a mineral. A good essayer ought to be very intelligent in this matter, that he may at once know what the proper operations are which are requisite to the essay of any given mineral.

As metals are very unequally distributed in their ores, we should be apt to make false and deceitful essays, if we did not use all possible precautions that the proportionable quantity of metal produced by an essay shall be nearly the medium contained in the whole ore. This is effected by taking pieces of the mineral from the several veins of the mine if there be several, or from different places of the same vein. All these minerals are to be shaken together with their matrixes. The whole is to be well mixed together, and a convenient quantity of this mixture is to be taken for the essay. This is called the *lotting* of the ore.

As essays, particularly the first, are generally made in small, essayers have very small weights corresponding to the weights used in the great; that is, to the quintal or hundred pounds weight, to pounds, ounces, drams, &c. The essay quintal and its subdivisions vary according to the difference of weights in different countries; and this occasions some confusion when these weights are to be adjusted to each other. Tables of these weights are found in treatises of essaying; and particularly in that written by Schlutter, and translated and rendered more complete by Hellot, which contains all the details necessary for the subject.

The custom is to take, for the essay quintal, a real weight of a gros, or a dram, which in France is equal to 72 grains; but as the whole dram represents 100 pounds, each grain represents a pound and a fraction of a pound; and hence some difficulty and a confusion arise in making the subdivisions. A better method is that of Mr Hellot, which is to make the fictitious or essay quintal equal to 100 real grains, and then each grain represents a real pound. This essay quintal, is sufficiently exact for ores of lead, tin, copper, iron, antimony, bismuth, and mercury. But for ores of silver and gold, another representation is convenient: for these metals, as Mr Hellot says, are generally in so small quantity, that the button or small piece of metal obtained in the essay could not be accurately weighed if 100 real grains were made to represent a quintal; and the difficulty of separating the gold from so small a quantity would be still greater. These motives have induced Mr Hellot to use for these ores a fictitious quintal 16 times bigger; that is, equal to 1600 real grains, which represent 1600 ounces; that is, 100 lb. or quintal. The ounce being represented by a grain, its several subdivisions must be represented by fractions of

Effaying of Ores.

of a grain. Thus 12 grains of the fictitious quintal correspond with $\frac{5}{48}$ of a real grain (†); and this latter quantity may be accurately weighed in essay-balances: which when well made are sensible to a much less weight. See *(Essay)*-BALANCE.

† The pounds, of which 100 are here supposed to make a quintal, are called Paris pounds, one of which contains 1269 Troy grains.

When a quintal of an ore to be essayed has been weighed, and lotted, as we described above, it is to be roasted in a test under a muffle. It is to be washed, if necessary; and, in short, the same operations are to be made in small which are usually done in great. Additions also are to be made, and in proper proportions, according to the peculiar nature of the ore. The fluxes generally mixed with the essays in ore are three, four, or five parts of black flux; one, two, or three parts of calcined borax; and one half of that quantity of decrepitated common salt. The more refractory the ore is, the more necessary is the addition of these fluxes: then the whole mixture is to be fused either in a forge or in a melting or essay furnace.

To make essays well, all possible attention and accuracy are to be employed. This object cannot be too much attended to; for the least inaccuracy in weighing, or loss of the smallest quantity of matter, might cause errors, so much greater as the disproportion betwixt the weights employed and those represented is greater. The most minute accuracy therefore is necessary in these operations. For instance, the essay-balances ought to be small, and exceedingly just. The ore ought not to be weighed till it has been reduced to gross powder fit for roasting; because some of it is always lost in this pulverization. When the ore is roasted, it ought to be covered with an inverted test; because most ores are apt to crackle and disperse when first heated. To make the fusion good and complete, the precise degree of fire which is requisite ought to be employed; and when it is finished, the crucible ought to be struck two or three times with some instrument, to facilitate the disengagement of the parts of the regulus from the scoria, and to occasion their descent and union into one button of metal. The crucible ought not to be broken, nor its contents examined, till it is perfectly cold.

Upon breaking the crucible, we may know that the fusion has been good, if the scoria be neat, compact, and equal; if it has not overflowed or penetrated the crucible; if it contain no metallic grains; and if its surface be smooth, and hollowed in the middle. The regulus or button ought to be well collected, without holes or bubbles, and to have a neat convex surface; it is then to be separated from the scoria, well scraped and cleaned; and, lastly, is to be weighed. If the operation has been well made, its weight shows the quantity of metal which every real quintal of ore will yield in the great. If the perfect success of this essay be in any respect doubtful, it ought to be repeated; but the best method at all times is, to make several essays of the same ore. Some small differences are always found, however well the essays may have been made. By taking the medium of the results of the several operations, we may approach as nearly as possible the true product of the ore.

Lastly, as mines are not worked, nor founderies established (which cannot be done without considerable expence), till the ore has been essayed, 10 or 12 real pounds of the ore ought to be previously essayed; and essayers ought to be furnished with necessary furnaces and instruments for these larger essays.

In Part II. to the several articles of the ores of metals, we shall add the most approved method of essaying these ores. We shall here only further observe in general, that the methods commonly practised for essaying ores of imperfect metals, and semimetals especially, are insufficient to procure the whole quantity of metal contained in ores, or even so much as is obtained in the smelting of large quantities of ores; and that therefore the result of essays is not to be considered as the precise quantity contained in an ore, but generally only as an inaccurate approximation to that quantity. M. Gellert ascribes one cause of the want of success of these operations to the alkaline salts employed as fluxes to the ores, by which most metallic calces are partially soluble, but more especially so when any of the sulphur of the ore remains; which, by uniting with these salts, forms a hepar of sulphur which is the most powerful of all solvents. He proposes therefore to omit the black flux, and other alkaline salts, and to add nothing to the ore but powder of charcoal and some fusible glass. This method, he says, he learned from Mr Cramer, and has himself used with much success in the essays of iron and copper: but finding that other imperfect metallic substances could not sustain the heat necessary to effect the fusion and vitrification of the unmetallic parts of the ore without being partly dissipated, he found it necessary to add in the essays of these latter metallic matters some borax, by which the fusion might be completed with less heat. As we consider this as a considerable improvement in the art of essaying ores, we shall, to the articles of the several ores, add not only the processes commonly prescribed, but all those of Mr Gellert, according to the method here mentioned.

PART II.

Containing a summary Description of the principal ORES of each METAL, and the Methods of Essaying them.

SECT. I. *Ores of Gold.*

§ 1. PROPERLY speaking, no ores of gold exist: for as this metal cannot be allayed with arsenic, nor with sulphur, it is never found directly mineralised by these substances, as the other metals are. In the second place, if it be mineralised indirectly by the union it contracts with other metals naturally combined with sulphur and arsenic, so small a quantity of it only is found in these ores, that they

Ores of Gold.

they ſcarcely even deſerve the name of *improper ores of of gold.*

Hence gold is found either in its natural ſtate, of a certain degree of purity, poſſeſſed of all its properperties; or engaged with ſome other metals in certain minerals.

The gold which is found alone is called *na'ive* or *virgin gold.* This is generally incruſted, and fixed in different kinds of ſtones, principally in flints and quartz. Mr Cramer ſays, that the yellow brilliant ſpots of the blue ſtones called *lapis lazuli*, are native gold; but theſe are very ſmall.

Gold is alſo found in fat and muddy earths; and Mr Cramer affirms, that ſcarcely any ſand can be found which does not contain gold; but he acknowledges, at the ſame time, that the quantity is too ſmall to compenſate for the expence of obtaining it.

Laſtly, the largeſt quantity of native gold is to be found in the ſands of ſome rivers. It is chiefly collected in hollows at the bottom of theſe rivers, and at their ſeveral bendings. The gold is collected in theſe places by a natural operation, ſimilar to that of waſhing of ores.

A conſiderable quantity of gold is in the ſands of ſeveral rivers in France: ſo that perſons who collect it find enough to compenſate their trouble. Mr Reaumur, in a memoir that he gave in the year 1718 concerning the rivers of France which contain gold, enumerates ten of them: namely, the Rhine, the Rhone, the Doux, the Ceze, and the Gardon; the Arriege; the Garonne; two ſtreams which flow into the Arriege, called *Ferriet* and *Benagues;* laſtly, the Salat, the ſource of which is in the Pyrenean mountains.

The Ceze is the river which furniſhes the largeſt quantity of gold at certain times. Mr Reamur obſerves, that its particles are larger than thoſe of the Rhine and of the Rhone; and ſays, that in ſome days a peaſant will find gold to the value of a piſtole, and in others will ſcarcely find any.

The native gold found in rivers or elſewhere is never perfectly pure, or of 24 karats. It always contains a certain quantity of allay, which is generally ſilver. The gold of the French rivers, according to Mr Reaumur's trials, was found to be from 18 to 22 karats, that of the Ceze being the loweſt, and that of the Arriege being the pureſt.

Although gold, however, as above obſerved from Macquer, cannot be directly diſſolved by ſulphur, yet it probably may be mineraliſed by the intervention of other metallic matters. Thus, although no proper ore of gold exiſts, yet it is found in ſeveral mineral ſubſtances, in which it is always accompanied, as Cramer affirms, with a much larger quantity of ſilver; to which latter metal that author attributes its mineraliſed ſtate. The minerals containing gold are blend, cupreous and arſenical pyrites, ore of antimony, cinnabar, white ore of arſenic, vitreous and other ſilver ores, and the lead-ore called *galena.*

Gold is more frequently embedded in quartz than in any other matrix, but is alſo found in limeſtone and in hornblend. Gold mines are in general very precarious, as they do not form regular veins, nor is the gold uniformly diſtributed through a matrix.

Becher and Cramer think, that no ſand is entirely free from gold. The yellow, red, black, and violet-coloured ferruginous ſands, are ſaid to contain moſt gold. Mr Hellet relates, that in 11 eſſays of one kind of ſand, from a quintal or 921,600 grains, were obtained each time from 848 to 844 grains of noble metal, excluſive of the gold which remained in the ſcoria; and that of the metal thus obtained two thirds were gold, and the remaining third was ſilver. He ſays, that parcels of ſand taken up at very ſmall diſtances from each other contained very unequal proportions of gold.

Eſſaying of Ores of Gold.

The gold found in ſands is generally leſs pure than that which is imbedded in a ſolid matrix. Reaumur ſays, that a piece of gold, weighing 448 ounces, was ſhown to the Royal Academy at Paris, which was found upon eſſay to have different fineneſs in different parts of the maſs.

§ 2. *Ores and earths containing gold may be eſſayed* by the methods directed for the extraction of gold from large quantities of theſe auriferous matters, (ſee Part III.): or they may in general be eſſayed by being fuſed in a cupel or teſt, placed under the muffle of an eſſay-furnace, or in a crucible placed in an air furnace, with eight or ten times their quantity of lead if they be eaſily fuſible, and with a larger quantity of lead if they be difficultly fuſible; and by ſcorifying the earthy matters, while the lead becomes impregnated with the noble metals. Theſe operations are entirely ſimilar to thoſe employed for the ſeparation of ſilver from its ores by precipitation with lead; *a detail of which ſee ſubjoined under the ſection* ORES *of* SILVER, [*Proceſſes* I. III. IV. V. VI.]. Theſe metals are afterwards to be ſeparated from the lead by cupellation, in the manner directed in the article ESSAY (*of the value of ſilver and of gold*). The gold is then to be ſeparated from the ſilver by the proceſſes deſcribed in the article PARTING.

The quantity of lead to be added to the ore in this eſſay muſt be ſuch as renders the ſcoria very thin, that the whole gold may be imbibed by the lead. Some iron ores containing gold cannot be reduced into a ſcoria ſufficiently thin with 16 times their quantity of lead, unleſs the heat be at the ſame time conſiderably increaſed. When the ore is exceedingly refractory, the ſcorification ought to be promoted by adding to it four times its quantity of tartar, twice its quantity of nitre, and four times its quantity of litharge. This mixture is to be put into a good eſſay-crucible, and covered with the ſea-ſalt. The crucible is to be ſet in a forge-hearth, and expoſed gradually to heat, till the ſcoria has acquired ſufficient fluidity, and the lead has imbibed the noble metal.

See the methods which have been uſed for eſſaying auriferous ſands, under Part III.

SECT. II. *Ores of Platina.*

PLATINA is very rare, and has been but lately diſcovered. As, like gold, it cannot be allayed with ſulphur or with arſenic, probably no *ore*, properly ſo called, exiſts of this metal. Accordingly in the only mines of platina which we know, namely, the gold mines of Santafe near Carthagena, the platina is found native like the gold, and in its metallic ſtate.

Ores of Silver.

Sect. III. *Ores of Silver.*

§ 1. Next to gold, silver is the metal most frequently found in its metallic state, that is, not mineralised by sulphur or by arsenic. This silver, called also *native* or *virgin*, generally affects some regular form, and consists of filaments or vegetations of various figures. It is found in form of plates, of fibres, or of grains, or crystallized. It lies generally in quartz, flint, spar, slate, cobalt, and in silver ores. It is sometimes enveloped in a thin stony crust. It is generally allayed with some gold: but silver, like all the other metals, is much more frequently found mineralised by sulphur and by arsenic.

Three principal proper ores of silver are known, which are very rich, but very rare. These are:

1. The *vitreous silver ore.* This ore has no determinate figure, and has nearly the colour, softness, and fusibility of lead. It is very heavy, and contains three quarters of its weight of pure silver. In this ore the silver is mineralised by sulphur alone. Some expert artists imitate it very well by combining sulphur with silver by fusion in a crucible.

This ore, according to Cronstedt, is either in form of plates or of fibres, or is crystallized, or has no determinate figure. It may be imitated by adding about five parts of sulphur to one part of melted silver; in which operation most of the sulphur is consumed; or it may be imitated by exposing a plate of silver red-hot to the fumes of burning sulphur.

2. The *horny* or *corneous silver ore.* This ore is so called from its colour and semitransparency, by which it resembles horn or colophony. When suddenly heated, it crackles, as almost all ores do, and melts with a gentle heat. Two-thirds of it are silver, which is mineralised by sulphur and arsenic. This ore is very rare. Wallerius says, after Woodward, that it is found at Johaun-Georgen-Stadt in Saxony.

Corneous ore has various colours: white, pearly, brown, yellow, greenish, or reddish. It is foliated and semitransparent. It is somewhat ductile, and fusible with the flame of a candle. When heated, it emits, as Wallerius says, a sulphureous and blue flame, and, according to Cramer, also a very small quantity of an arsenical fume. Wallerius says, that it contains two thirds of silver, with a considerable quantity of sulphur, and a small quantity of arsenic. Lehman thinks that it is silver united with a little arsenic. But Mr Cronstedt says, that it is a luna cornea, or silver combined with marine acid; and that it is incapable of being decomposed but by substances which can unite with that acid. This latter opinion seems to be the most probable; as the ore, according to its description, is similar to luna cornea, and as it cannot be imitated by any mixture of sulphur and of arsenic with silver. The blue flame, and the smell slightly arsenical, which are emitted from heated corneous ore, are also observable from every combination of marine acid with a substance containing phlogiston.

3. *Red silver ore*, called also *rosiclare.* Its colour is more or less red; it is sometimes crystallized, very heavy, and is fusible like the abovementioned ores. In this ore the silver is mineralised by arsenic and by sulphur, but chiefly by the former. It also contains a little iron, and furnishes two-thirds of its weight of silver. Its red colour may proceed either from the iron it contains; or from the mixture of arsenic and sulphur; or, lastly, from the particular manner in which the arsenic is united with the silver, an example of which we have in the red precipitate of silver made by the neutral arsenical salt.

Red silver ore is either plated or solid, or crystallized, and frequently semitransparent. Its colour is various, from a dark grey to a deep red, according to the proportions of the two mineralising substances. It crackles and breaks in the fire, exhales an arsenical fume, and is readily fused. It is found generally in quartz, spar, crystal, horneblend.

Besides the three silver ores above described, the following ores contain silver mixed with other metals.

1. *Grey silver ore.* This contains copper and silver mineralised by arsenic and sulphur, and generally more of the former than of the latter metal; but as it is valued chiefly for the silver, it has been generally enumerated amongst silver ores.

2. *White silver ore* is an arsenial pyrites containing silver.

3. *Black silver ore* contains sulphur, arsenic, copper, iron, sometimes lead, and about a fourth part of silver, according to Wallerius.

4. *Plumose silver ore* is white or black, striated like plumb-alum, or like ore of antimony. It is silver mineralised by sulphur, arsenic, and antimony.

5. *Pech-blend.* In this blend silver, gold, and zinc, are mineralised by sulphur, probably by intervention of iron, by which the gold and zinc are rendered capable of uniting with the sulphur.

6. Silver is frequently found in *galena;* and sometimes in *martial pyrites;* in the *red ore of arsenic;* in various *ores of copper, lead, tin, iron,* and especially *cobalt;* in *blends;* in *yellow* or *red earths;* in *black* and *blue basaltes;* and also in *strata of stones* which do not appear externally to contain any mineral substance.

7. *Liquid silver ore* or *guhr of silver*, is a grey or whitish liquid mass, which contains, as Wallerius says, either native silver, or some fluid substances capable of producing it. Mr Cronstedt mentions, in the Swedish Memoirs, a water flowing through a mine in Norway containing silver. Another instance is also mentioned of a silver guhr, in the *Act. Erud. Upsal.* 1720.

8. Mr Von Justi pretends, that he has found silver mineralised by an *alkaline substance;* but he has not spoken sufficiently distinctly concerning it, to know whether he means a saline or earthy alkaline matter. Henckel also pretends, that by treating calcareous earth or certain clays with pyrites, silver may be obtained.

§ 2. *Ores of silver may be essayed* by the same methods which are employed for the extraction of that metal from large quantities of ores; which methods are different, and suited to the different qualities of the different ores. See Part III. Or, in general, ores and earths containing silver may be essayed by the following processes, which are copied from Dr Mortimer's English

Essaying of Ores of Silver.

English edition of *Cramer's Art of essaying metals, Part II. Process* 1.

PROCESS I.

To precipitate Silver by means of Lead from fusible Ores.

"POUND the ore in a very clean iron mortar into fine powder: of this weigh one decimastical centner or quintal, and eight of the like centners of granulated lead.

"Then have at hand the decimastical test, which must not as yet have served to any operation; pour into it about half of the granulated lead, and spread it with your finger through the cavity of it.

"Put upon this lead the pounded ore; and then cover it quite with the remainder of the granulated lead.

"Put the test thus loaded under the muffle of an essay-furnace, and in the hinder part of it; then make your fire, and increase it gradually. If you look thro' the holes of either of the sliders, you will soon see that the pounded ore will be raised out of the melted lead, and swim upon it. A little after, it will grow clammy, melt, and be thrown towards the border of the test: then the surface of the lead will appear in the middle of the test like a bright disc, and you will see it smoke and boil: so soon as you see this, it will be proper to diminish the fire a small matter for a quarter of an hour; so that the boiling of the lead may almost cease. Then again, increase the fire to such a degree, that all may turn into a thin fluid, and the lead may be seen, as before, smoking and boiling with great violence. The surface of it will then diminish by degrees, and be covered over with a mass of scorias. Finally, have at hand an iron hook ready heated, wherewith the whole mass must be stirred, especially towards the border; that in case any small parcels of the ore not yet dissolved should be adherent there, they may be brought down, taking great care not to stir any the least thing out of the test.

"Now, if what is adherent to the hook during the stirring, when you raise it above the test, melts quickly again, and the extremity of the hook grown cold is covered with a thin, smooth, shining crust; it is a sign that the scorification is perfect; and it will be the more so as the said crust adherent to the hook shall be coloured equally on every side: but in case, while the scorias are stirred, you perceive any considerable clamminess in them, and when they adhere in good quantity to the hook, though red-hot, and are inequally tinged, and seem dusty or rough with grains intersperced here and there; it is a sign that the ore is not entirely turned into scorias. In this case, you must with a hammer strike off what is adherent to the hook, pulverize it, and with a laddle put it again into the test, without any loss or mixture of any foreign body, and continue the fire in the same degree till the scoria has acquired its perfection and the abovementioned qualities. This once obtained, take the test with a pair of tongs out of the fire, and pour the lead, together with the scoria swimming upon it, into a cone made hot and rubbed with tallow. Thus will the first operation of the process be performed, which does not commonly indeed last above three quarters of an hour.

"With a hammer strike the scorias off from the regulus grown cold, and again examine whether they have the characteristics of a perfect scorification; if they have, you may thence conclude, that the silver has been precipitated out of the ore turned to scorias, and received by the lead.

"When the scorification lasts longer than we mentioned, the lead at last turns to scorias, or litharge and the silver remains at the bottom of the vessel: but the fire must be moderately supplied, and the vessels be extremely good, to produce this effect; for they seldom resist to the strength of the scorias long enough; so that the whole scorification may be brought to an end; which has afterwards this inconveniency, that the silver is dissipated by grains in the small hollows of the corroded ore, and can hardly be well collected again, when the ore has but little silver in it. Nay, there is still more time to be consumed to obtain the perfect destruction of the lead, by means of the combined actions of the fire and air, because the scorias swimming at the top retard it considerably.

"In this process, the sulphur and the arsenic of the silver-ore; when the ore is broken small, and extended widely in a small quantity, are in part easily dissipated by the fire, and in part absorbed by the lead; the lighter part of which, swimming upon the heavier, becomes very clammy by means of the sulphur which is in the ore; but when this is dissipated by the violence of fire, it turns into glass or scorias: but when arsenic is predominant in the ore, the plumbeous part turns immediately into a very penetrating and very fusible glass, having a dissolving efficacy, unless the arsenic lies hidden in a white pyrites or cobalt. For this reason, the fixed part of the ore, which is no silver, is dissolved by that glass, melts, and assumes the form of scorias. The unmetallic earths and the pure copper or lead ores thereto adherent are of this kind. The silver then remains immutable; and being freed of these heterogeneous bodies, which are partly dissipated and partly melted, it is precipitated and received by the remaining regulus of lead. Therefore this process completed by three distinct operations; viz. 1. By roasting. 2. By scorification. 3. By the melting precipitation of the silver, which is the result of the two former operations.

"The ore must be pulverised very fine, in order to increase the surface, that the dissipation of the volatiles and the dissolution by litharge may be sooner effected. This pulverising must then be done before the ore is weighed, because there is always some part of the ore adherent to the mortar or iron plate on which it is made fine; which part being lost, the operation is not exact. Erker was in the right when he prescribed eight centners of lead for the subduing of fusible ores. Nevertheless, it must be owned, that this quantity is superfluous in some cases. However, as the fluxibility of the silver-ore depends upon the absence of stones, pyrites, &c. it is easy to see, that there are an infinite number of degrees of fluxibility which it would be needless to determine exactly, and most commonly very difficult to determine by the bare sight. Besides, a little more lead does not render the process imperfect; on the contrary, if you use too

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small a quantity of lead, the scorification is never completely made. Nay, there are a great many ores containing sulphur and arsenic in plenty, that destroy a considerable quantity of lead; such are the red silver-ore, and that wherein there is a great deal of the steel-grained lead-ore. If the fire must be sometimes diminished in the middle of the process, it is in order to hinder the too much attenuated litharge, which is continually generated out of the lead, from penetrating the pores of the test, and from corroding it; which is easily done when the fire is overstrong; for then the surface of the vessel which is contiguous to the lead contracts cavities, or, being totally consumed by small holes, lets the regulus flow out of it. The vessels that are most subject to this inconvenience are those in the materials of which lime, plaster, and chalk are mixed. Nay, these bodies, which are in their nature refractory, being eroded during their scorification, at the same time communicate a great clamminess to the scoria; so that a great quantity of the mass remains adherent to the test, in the form of protuberances, when you pour it out; whereby a great many grains of the regulus are detained."

PROCESS II.

The regulus obtained by the process I. contains all the silver of the ore, and the unscorified part of the lead. The silver may be afterwards separated from the lead, and obtained pure by *cupellation;* which process is described under the article Essay *(of the value of Silver.)*

PROCESS III.

If the silver-ore cannot be washed clean, or if it be rendered refractory by a mixture of unmetallic earths and stones the scorification of these earthy matters frequently cannot be completed by the process I. Cramer therefore directs, that such ores shall be treated in the following manner.

"Bruise the ore into an impalpable powder, by grinding in a mortar; to a docimastical centner of it add a like quantity of glass of lead finely pulverised; for the more exactly these two are mixed together, the more easily the scorification afterwards succeeds. Put this mixture, together with 12 centners of lead, into the test, according to process I. then put the test under the muffle.

"Make first under it a strong fire, till the lead boils very well, when you see it so, diminish the violence of the heat, as was directed in the first process; but keep it thus diminished a little longer: then, finally, again increase the fire to such a degree, till you perceive the signs of a perfect scorification and fusion. *See the whole process I.* Now this process lasts a little longer than the foregoing, and requires a greater fire towards the end.

"It sometimes happens that a very refractory ore cannot be dissolved by litharge; and that a mass, which has the clamminess of pitch, swims upon the regulus and upon the scorias themselves which are already subdued in part: when you see this, shut the vents of the furnace to diminish the fire; then gently touch this refractory body with a small iron cold hook to which it will immediately stick; take it off softly, not to lose any thing; pound it into a fine powder, adding a little glass of lead, and put it again into the test; then continue the scorification till it is brought to its perfection. But you must always examine the scoria of your refractory ore, to see whether there may not be some grains of regulus dispersed in it; for sometimes the scorias that grow clammy retain something of the metal; which if you suspect, pound the scorias into a fine dust, and thus the grains of metal will appear if there are any left, because they can never be pounded fine. The silver is separated from this regulus by cupelling, as in Process II.

"All earths and stones are refractory in the fire: for although some of them melt naturally in the fire, as those that are vitrifiable do; nevertheless all the others, a very few excepted, melt much more difficultly than metals, and never become so thin in the fusion as is required for the sufficient precipitation of a precious metal. But litharge itself does not conveniently dissolve these refractory matters by the help of fire alone, unless you add some mechanical mixture to them; for the very moment the said litharge penetrates through the interstices of the refractory ore, and begins to dissolve it, a tenacious mass is produced, which hardly admits any farther dilution by the litharge. You may see it plain, if you make coloured glasses with metallic calces: if you pour carelessly upon them a calx that gives a colour, you will never obtain that they may be equally dyed on every side, even although you should torture them for whole days together in a great fire. Nay, glass already made can never be diluted by only pouring salts and litharge upon it. Wherefore you must use the artifice of glass-makers, who, in the making of the most perfect glasses, take great care, before they put the species of their ingredients into the fire, to have a mechanical mixture precede, or at least accede, during the fusion itself, which is done here by pounding glass of lead mixed with the ore; but if you think that your glass of lead is not sufficiently fusible, you may add to it litharge melted first, and then pounded into a fine powder.

"As this scorification requires a longer and a greater fire than the foregoing, and as a greater quantity of litharge is moreover requisite to subdue the refractory scoria; it is easy to see why a much greater quantity of lead must be used here than in Process I.; and, although less lead is often sufficient it is nevertheless proper always to use the greatest quantity that can be necessary; lest, for instance, it should be necessary to try so many times the lead alone to make it evident how much silver the lead when alone leaves in the coppel. Nor need you fear lest any thing of the silver be taken away by the lead, provided the coppels be good, and the coppelling duly put in the execution; for you can hardly collect a ponderable quantity of silver out of the collected fume of the lead, which rises during the coppelling, as well as out of the litharge that is withdrawn into the coppel."

PROCESS IV.

If the ore be rendered refractory by pyrites, Cramer directs that the silver should be precipitated by lead in the following manner. *(Art of Assaying,* Part II. proc. 4.)

"Break

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"Break your ore into a rough powder, and put a centner of it into the test; put upon this another test in the manner of a tile; put it under the muffle hardly red hot: increase the fire by degrees. There will always be a crackling: which being ended, take away the upper test; for when the vessels have been red-hot about one minute, the ore ceases to split. Leave the ore under the muffle till the arsenic and the sulphur are for the most part evaporated; which you will know from the cessation of the visible smoke, of the smell of garlic, or the acid; then take away the test, and leave it in a place not too cold, that it may cool of itself.

"Pour out, without any dissipation, the roasted ore, and with a knife take away what is adherent to the vessel; pound it to a most subtile powder, and grind it together with an equal weight of glass of lead; and, finally, scorify the whole collected ore in the same test wherein the testing was made, unless it has contracted chinks, as was described in Process III.

"*Remarks.* Yellow pyrites-ores contain a very great quantity of sulphur, even greater than is necessary to saturate the metal that lies hidden in them.—For which reason this superfluous sulphur dissipates in a middling fire; but if it had been mixed with lead, it would have rendered it refractory, nor could it afterwards be dissipated from it without a considerable destruction of the lead. The white arsenical pyrites turn also a great quantity of lead into glass, on account of the abundance of the arsenic they contain. For which reason these ores must be previously roasted, that the sulphur and arsenic may be dissipated. Nor need you fear lest any part of the silver be carried away with the arsenic; for when arsenic is separated from any fixed body, by a certain degree of fire, it carries nothing of that body away with it."

PROCESS V.

Silver may be precipitated from its ore by cupellation only, in the following Process, given by Cramer. [*Art of Assaying, Part* II. *Proc.* 9.]

"Pound one centner of ore; roast it in the manner directed in the last process; beat it to a most subtile powder, and if it melts with difficulty on the fire, grind it together with one centner of litharge, which is not necessary when the ore melts easily: then divide the mixture or the powder of the ore alone into five or six parts, and wrap up every one of them severally in such bits of paper as can contain no more than this small portion.

"Put a very large coppel under the muffle; roast it well first, and then put into it sixteen centners of lead: when the lead begins to smoke and boil, put upon it one of the said portions with the small paper it was wrapt up in, and diminish the fire immediately, in the same manner as if you would make a scorification in a test, but in a lesser time. The small paper, which turns presently to ashes, goes off of itself, and does not sensibly increase the mass of the scorias. The ore proceeding therefrom is cast on the border, and turns to scorias very soon. Increase the fire again immediately, and, at the same time, put another portion of the ore into the coppel, as was just now said. The same effects will be produced. Go on in the same manner, till all the portions are thrown in and consumed in the lead. Finally, destroy the remaining lead with a stronger fire.

"The silver that was in the ore and in the lead will remain in the coppel. If you deduct from it the bead proceeding from the lead, you will have the weight of the silver contained in the ore. If the ore employed was easy to be melted, all the scoria vanishes; but if it was refractory or not fusible, all the scoria does not always go away, but their remains something of it now and then in the form of dust. A great many ores and metals may be tried in this way, except only such as split and corrode the coppels.—There are likewise some of them which must be previously prepared in the same manner as is required to render them fit for going through a scorification.—*See the foregoing Processes.*

"*Remarks.* The ore thrown at several times upon lead boiling in a coppel may be dissolved without the foregoing scorification; but this is very far from having an equal success with all kinds of ores; for there are ores and metals which resist very much their dissolution by litharge; and which being on this account thrown on the border, are not sufficiently dissolved; because the litharge steals away soon into the coppel. Nevertheless, there are some others which vanish entirely by this method, except the silver and gold that was contained in them.

"A previous roasting is necessary, first, for the reasons mentioned, and then because the ore thrown upon boiling lead should not crackle and leap out; for, having once passed the fire, it bears the most sudden heat."

PROCESS VI.

Silver may be precipitated out of the same bodies as were mentioned in the foregoing processes by scorification in a crucible. [*Cramer, Proc.* 15.]

"The body out of which you intend to precipitate silver must be previously prepared for a scorification by pounding and roasting, as mentioned in the former processes. Then in the same manner, and with the same quantity of lead, put it into a crucible strictly examined, that it be entire, solid, not speckled with black spots, like the scoria of iron, especially at its inferior parts, and capable of containing three times as much. Add besides glass gall and common salt, both very dry, and enough, that when the whole is melted the salts may swim at top at the height of about half an inch.

"Put the crucible thus loaded in a wind-furnace; shut it close with a tile; put coals round it, but not higher than the upper border of the crucible. Then light them with burning coals, and increase the fire till the whole melts very thin, which will be done by a middling fire, maintained always equal, and never greater; leave it thus for about one quarter of an hour, that the scorification may be perfectly made. Take off the tile and stir the mass with an iron wire, and a little after pour it out into the mould. When the regulus is cleaned from scorias, try it in a test by coppelling it.

"*Remarks.* The scorification of any ore whatever, or of any body fetched out of ores, may indeed be

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be made by this apparatus, as well as in a test under a muffle: but it serves chiefly to the end that a greater quantity of metal may be melted from it with profit. For you may put many common pounds of it at one single time into the crucible; but then you need not observe the proportion of lead prescribed in the foregoing process; nay, a quantity of lead two or three times less is sufficient, according to the different qualities of the object. But the mass will certainly be spilt, unless you choose a very good crucible; for there is no vessel charged with litharge that can bear a strong fire having a draught of wind, without giving way through it to the litharge.

"You add glass-gall and common salt, that they may forward the scorification, by swimming at top; for the refractory scoria rejected by the litharge, and adhering between this and the salts that swim at top, is soon brought to a flux, and the precipitation of the silver is thereby accelerated. They also hinder in a manner a small burning coal fallen into the crucible, from setting the litharge a boiling, which troubles the operation; for the litharge or glass of lead, especially that which is made without any addition, so soon as the phlogiston gets into it, rises into a foamy mass, consisting of a multitude of small bubbles very difficult to be confined, unless the phlogiston be entirely consumed, and the litharge reduced to lead, which sometimes rises above the border of the vessel."

The *corneous ore*, if it really be, as Cronstedt says, a luna cornea, ought to be treated in some of the methods directed for the reduction of luna cornea. See *Chemistry-Index*.

PROCESS VII.

Silver and gold may be extracted from their ores by mercury.

A new method of extracting the precious metals by means of amalgamation with mercury has lately been introduced into Germany. The attraction between these has indeed been known from the most remote antiquity: Vitruvius informs us, that by this means gold might be recovered from embroidery and old cloaths; and Pliny mentions the gilding of brass and other metals by the same means. From time immemorial mercury has been made use of in the streaming for gold, in order to purify and collect together the gold dust which is dispersed in the sands; and almost all nations who practice this use the same process. The gold sand, after being washed, is triturated with quicksilver, and the superfluous metal separated by straining through leather. By the miners it was used in a similar manner; the stones containing gold being first pounded and then triturated in mills along with the mercury. But it was soon found, that in these mills there was a large quantity left behind in the residuum, so that it was necessary to subject what was left to the action of fire; on which account the mills were deemed unnecessary, and are now almost every where disused. The process of extracting gold and silver by amalgamation, however, was looked upon to be essentially deficient, by reason of an opinion which prevailed among the chemists, that mercury could not dissolve either of these metals except in their pure and perfect state; whence it was supposed, that a great quantity which fire could have extracted was left by the mercury. This opinion was supported by the most celebrated metallurgists, as Schlutter, Gellert, Wallerius, and Kramer; whence it became generally believed, that amalgamation would never answer in great operations. But of late Baron Inigo Born has not only demonstrated that this can be done to great advantage, but has actually intoduced it, notwithstanding that some difficulties were thrown in his way. The following is an account of the methods which have been practised for separating gold and silver from their ores by means of quicksilver.

Baron Born's New Process, &c translated by Raspe, 4to, 1791.

This process was introduced into some of the mines of Mexico in 1566 by Don Pedro Fernandez de Velasco, and in 1571 into some of those of Peru by the same person; and from thence it quickly spread thro' all the mines in the south and north-east parts of America, insomuch that it is almost the only method used in that part of the world for extracting these metals. The richer ores, however, are purified by fusion with lead; and our author informs us, that formerly the poorer kind of ores were certainly thrown away, and when the method of amalgamation was introduced into Peru, the old barrows were searched for the ores which had been rejected as useless, but were now put to the quicksilver.

In the year 1588, Don Juan de Corduba, a Spaniard, applied to the court of Vienna, proposing to extract silver from its ores, whether poor or rich, by mercury, and in a short space of time. He made some experiments upon different kinds of ore, which on a small scale succeeded very well, but on attempting it with 20 quintals of it he failed; and as Lazarus Erker, who was employed to give in a report concerning it, disapproved of the method, it was not pursued any farther. The reasons alledged in Baron Born's book for this failure are, that he did not calcine his ore; that he did not use any salt; and that the weather was too cold; though this last circumstance might have been remedied had Corduba attended to it.

Another Latin and anonymus account of the mode of amalgamation is preserved among the records of the aulic chamber. It is directed to the emperor, but the year in which it was written is not mentioned. According to the account given by the author of this paper, he had examined the mines of Guatimala in New Spain, and made some useful regulations for them. He directs the ore to be calcined in furnaces like lime-kilns, the fire being kept up according to the nature of the ores, after which they are to be reduced to powder in mills or stamps. The pulverised matter is then passed through fine iron sieves, and put into earthen or copper vessels by 10 or 20 quintals at a time; more or less salt being mixed with it according to circumstances. The light-coloured ore requires 50 lb. to every thousand, and the darker somewhat more. To this mixture are to be added five pounds of dry tartar two pounds of pulverized horn, and three pounds of brick-dust. Some kinds of ores require but a small quantity of these additions.

After the mixtures are put into the boilers, as much water is added as will make the whole of the consistence of paste moderately thick; the vessels must be exposed to sunshine, or kept in a place warmed artificially, adding more water when the matter begins to dry; and it must

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must be ſtirred up three or four times a-day. At the expiration of three or four days, various colours appear upon the ſurface. After this 15 lb. of brimſtone is to be added to every thouſand pounds of ore, and the whole worked over again; but this addition is by the baron conſidered as quite ſuperfluous. Laſtly, 100 lb. or leſs of quickſilver is added, according to the nature of the ore; the whole maſs is carefully worked over, and left at reſt for 10 hours. A fire muſt next be kindled under the boiler, and the matter it contains triturated or ſtirred for two days together; keeping it always ſufficiently diluted by a proportional quantity of water. It is, laſtly, allowed to reſt for 12 hours, and then dried.

When this operation is ſucceſsfully performed, if the ores be rich, particles of amalgam will be ſeen in it: theſe are collected, waſhed out, and kept for further uſe, the leavings being carried to a place fit for waſhing over. This place ought to be on the ſlope of an hill, where a kind of pit is dug out and lined with brick and mortar, and ought to be large enough to contain 25 quintals. A ſtream of water is then made to run upon it, and the matter ſtirred without intermiſſion. The ſuperfluous water runs over the rim of the pit, and carries off the lighter ſtony and earthy particles, the heavy amalgam remaining at bottom. This is then to be mixed with the ſmall clots already mentioned, which were taken out of the maſs originally, and preſſed through a cloth made of hemp or coarſe linen. The quickſilver, which comes through clean, is kept for farther uſe; the remainder diſtilled off in proper veſſels, and the remaining ſilver melted into ingots. By this method it is ſaid that even very poor ores are worked to advantage, the expence being very moderate.

The following method of extracting gold from its ores is very much recommended by our author: "The auriferous ſand, which contains gold grains and gold-duſt, is concentrated by waſhing; and without any calcination goes to the abovementioned waſhing-pit, which for this purpoſe need not be ſo large. On its upper part is fixed a ſquare launder, about 12 feet long, covered in the bottom with a woollen cloth, in order to retain any part of the gold-duſt which may be carried over with the water and ſtuff gently ſtirred in the pit. When the water carries off no more mud, but runs clear, the farther ſupply is to be ſtopped; the water in the pit is pumped or taken out with buckets; the coarſer ſand in the bottom is ſeparated or ſcraped off by hands: and the finer heavieſt ſand at the bottom is mixed with quickſilver. Then it is ſqueezed through a piece of cloth; the quickſilver comes off without any gold, which ſeparated from the ſand remains as an amalgam, and is pure after the remaining quickſilver has been evaporated. The ſand and heavier duſt remaining on the launder is waſhed and treated in the ſame manner.

"The auriferous ores and loadſtones, however, which riſe from different mines, are calcined like ſilver ores, more or leſs as the nature of their matrixes will direct. Then they are ground and ſifted; and the auriferous ſtuff, thus prepared, is put into heaps, expoſed to the ſunſhine, and worked and turned about for three or four days. It requires no ſalt. Afterwards ſulphur, and at laſt quickſilver, are added and mixed with it. There is no occaſion for fire under the veſſel in which it is triturated, except in winter; and two days after, though not dried, it is immediately carried to the waſhing-pit, and treated like the amalgam of ſilver.

"This method of extracting gold and ſilver is ſo certain and ſafe, that when other methods of amalgamation extract only one ounce of gold and ſilver, this produces three or four from the pooreſt ores in a ſhorter time and with leſs expence."

P. Joſeph Acoſta tells us, that at Potoſi 6000 or 7000 quintals of quickſilver are annually conſumed in the dreſſing of the ore, not to mention what is recovered from the leavings of the firſt waſhing. Theſe leavings, called *lamas*, are burnt in particular furnaces in order to extract the remaining quickſilver; and there are upwards of 50 ſuch furnaces near Potoſi and Tarapaja. The ore refined there amounts, according to the beſt information, to the immenſe quantity of 300,000 quintals. Only about 2000 quintals of the quickſilver are recovered, which ſhows a loſs of about two pounds of quickſilver on every quintal of ore. The ores are of different natures, and in proportion to the ſilver they contain require more or leſs quickſilver. That which contains moſt, requires naturally the greateſt quantity of quickſilver; though ſome of the workmen pretend that there is a kind which contains very little ſilver, and yet requires a great deal of mercury: but whether this be owing to the ignorance of the workmen, or to the mercury being abſorbed by ſome other matter, is not generally known. The ore is firſt pulveriſed in mills, and then paſſed through iron or braſs ſieves. The mills will grind, when properly regulated, 30 quintals in the ſpace of 24 hours. The pulveriſed matter is put into heaps in the open air, and ſalt is mixed with it in the proportion of 5 to 50 quintals of the ore, in order to macerate and cleanſe it of its impurities, that the quickſilver may the more readily amalgamate with the metal. Upon theſe heaps, and while they are ſtirring, the quickſilver is preſſed through a cloth. Before the invention of fire-places, the ore was repeatedly kneaded with quickſilver in wooden troughs, and formed into large round maſſes, which were left in that form for two days; after which they were worked again, until the metals appeared to be embodied together, which took from 9 to 20 days; but it was afterwards found that heat aſſiſted the operation ſo far, that by means of proper ovens the ſame might be accompliſhed in five or ſix days. When the quickſilver has taken up the ſilver, and wholly ſeparated it from its matrix the lead and the copper, the ovens are opened, the matter is taken out, and the quickſilver expelled and recovered in the following manner. The mixture is put into water troughs, and ſtirred therein by means of mills and water-wheels, by which the earthy and extraneous particles are waſhed away, and the amalgam ſettles at the bottom. The ſediment looks like ſand. It is further waſhed over in flat plates, and perfectly cleanſed; what goes off with the water is collected for further uſe under the name of *relaves*. When the amalgam is become clean and bright by this method, it is put into a cloth and ſqueezed out. This uncombined quick-

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silver runs off, and the remaining body of amalgam contains five parts of quicksilver and one of solid metal. It is made into masses named *pinnas*, having the form of a sugar loaf, hollow within, and weighing about 100 pounds. They are exposed to a strong fire in order to expel the quicksilver, after being put into pots covered with earthen heads. The silver still appears in the form of amalgam, but is reduced to one sixth of the former weight. Its texture is spongy, and the quality of the metal so fine, that the silversmiths cannot work it, neither can it be formed into coin, without an alloy. Baron Born observes, however, that it is only cold amalgamation which produces silver of such uncommon fineness; by hot amalgamation it is generally alloyed with copper, which cannot be parted from it without cupellation.

The most circumstantial account of the amalgamation of silver ore is that of Alonzo Barba. He divides the ores into two classes: 1. those which are best treated by fire and fusion; and, 2. such as are most fit for amalgamation. Those called *pacos* and *tacana*, may be amalgamated; but that none of their richer contents may be lost, it will be best to combine them with lead, and proceed by cupellation. The former of these ores has no lustre or brightness. It is said to be of a reddish yellow, soft and friable; seldom rich in silver, and mostly valuable on account of its being easily got from the mine. Tacana is a rich silver ore, of a black colour, sometimes of a grey or of an ash-colour; or a brown, rich, silvery earth. 3. The *plomo* is too rich for pulverisation and amalgamation, and is therefore simply melted down with the tacana. This seems to be the same with the horn-silver ore; and is described as almost entirely consisting of native silver, of a black, grey, or greenish-white colour. Barba says that they found at Potosi some plomo of a cinnabar colour, which they had not seen any where else; but Baron Born thinks that here he has mistaken the red silver ore for another species. Frezier asserts, that in what he calls the *plomo ronco*, the native silver appears upon rubbing or scratching it, and that it gives white and very pure silver by simple fusion without any amalgamation. In the imperial cabinet at Vienna, there is a specimen weighing about a pound, of black horn silver ore from Potosi, on the polished surface of which the virgin silver appears very plainly. 4. The *machacado* (virgin silver or gold grown in the matrix in the form of wire or hair), is amalgamated in the mortar. 5. The *soroches* (lead ores containing silver), are melted along with the *rosicler* and *conchiso*, two kinds of red silver ore. 6. The *negrillos* (grey copper and white silver ores) may be refined by amalgamation, though they are more fit for fire.

Besides this classification in such as are fit for fire, and those for amalgamation, the ores require further to be sorted into such as require the addition of particular substances for their amalgamation. Vitriol is generally hurtful, especially when salt is added to the vitriolic ores; and it requires the addition of iron, tin, lead, and lime, in order to counteract its effects; but in some cases it is of service, and promotes amalgamation. The calcination of vitriolic ores is of no service, but rather the contrary, as it disengages the vitriol, and brings on a vitriolic efflorescence. It may, however, be separated by washing till the water comes off tasteless and sweet. The amalgamation is disturbed by sulphur, bitumen, and antimony, only by the smoothness and needle-like figure of the particles, which reduce the quicksilver to a kind of dust. The ores mixed with these always run into reguli, and must therefore be put into a strong calcining fire; if melted without calcination, they would run entirely into dross and scoria.

The finer the ores are pounded so much the better; and after putting the powder thro' a fine sieve, the coarser part goes again to the mill: they ought to be previously burnt, in order to assist the operation of grinding. The best method of obtaining fine powder is by washing over; but as this is very apt to pack and turn clammy, it ought to be mixed with sand.

The ores are known to be sufficiently calcined by their change of colour and loss of brightness. Barba tells us, that all bright ores must be calcined, but with great care, that no vitriol may be disengaged, as that proves injurious to the amalgamation; but baron Born says, that one of the greatest objects in the calcination of the Hungarian ores is to decompose the sulphur into vitriol, as promoting the decomposition of the salt. The amalgamation is likewise promoted by burning and calcination, in as far as it promotes the pulverization of the ore, and assists the action of the quicksilver; but it is chiefly useful in the black and grey silver ores. It can only be determined by circumstances whether it be better to pulverize the ores before or after calcination. Their value is best known by pounding them previous to calcination. The stuff must be constantly stirred during the time it is calcining, and some powder taken from the mass to be tried with quicksilver and salt. The thickening of the quicksilver, and the grain of the stuff, show what additions are necessary, or whether calcination be completed or not. When ores are calcined in lumps, the fire does not act equally upon all their parts; though this method is attended with the advantage of losing much less dust, as well as saving the expence of stamps and mills.

Ores cannot be calcined in reverberatory furnaces, as the heat would run it together, and part of the metals themselves would be carried off by the strong current of air and the violent smoke. Barba recommends a furnace of an oblong square figure, with three vaults over each other; the fire is put in the lowermost, and the ore into the two upper ones. The heat circulates by means of lateral openings in the walls, and is let out on the back without a flue. The heat is graduated by registers and dampers on the outside.—Whatever kind of furnace, however, is used, some of the ore will have clotted, and must therefore be ground to a fine powder; but to prevent as much as possible these inconveniences, the hard ores ought to be calcined before they go to the mill, and the soft ones after, but with proper additions. The irony ores, which resist the fire longer, are calcined with an addition of sulphur, or of sulphureous and antimonial matter, proportioned to the iron they contain; but sulphureous and antimonial ores require to be calcined with the scoria of iron. Arsenical ores, or those mixed with orpiment and sandarac, are calcined with lead glance; and those mixed with white or black bitumen, must be calcined with iron scoria or pounded limestone.

The

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The impurities of ores, and the additions proper to be made to them, are determined by pounding them coarsely, and throwing them upon a heated plate of iron. If the smoke be white or black, it shows a mixture of bitumen of these colours; if yellow, it shows orpiment; if red, sandarac; if greenish-yellow, sulphur.

Salt ought not to be used in the calcination of ores as it would calcine the silver; and the duration of the calcining must be determined by the change of colour which the ores undergo by calcination by themselves, and the brightness they assume by trituration with quicksilver. It is also a mark of sufficient calcination when antimonial and sulphureous ores no longer send out a disagreeable smoke; if the thick and black smoke of bituminous ores become white; and if the silver in the stuff appears in white glittering sparks. Vitriolic ores may also be calcined in the same manner; but they require a longer time with the addition of alum and salt: they, however, require no farther addition in the subsequent operations; and in the course of four days all their silver will be taken up by the quicksilver. Less quicksilver will also be lost; for as there is no occasion for the frequent turning and working of the heap, a very small part of it only can be turned into useless dust. Vitriolic ores ought always to be well washed with water before they are calcined; and if there is still a suspicion of their being vitriolic, they must be tried by quicksilver: if it takes a lead-colour, the stuff must be washed till iron put into it no longer takes a copper colour. The lixivium is kept as an useful addition to some ores.

Amalgamation, according to Alonso Barba's method, is performed in three ways, viz. in heaps or caxons, in the boiler, and in mortars.

1. *In heaps.* Before the operation takes place in the large way, an essay is made of three or four pounds of the fine sifted powder taken from the general quantity; and according to the produce of this he calculates that of the whole. He tries it also with quicksilver, to know perfectly the method he is to follow, and the additions that are to be made. In this essay the followed method is adopted: 1. The matter is elixated, to extract the vitriol if there be any. 2. One pound of the lixiviated matter is tried with quicksilver and salt, carefully observing the colour and its change. If the quicksilver assumes the appearance of silver filings, and these quicksilver flakes become thinner and thinner, it proves that the amalgamation goes on successfully, and that there is no occasion for any addition. The whole is stirred from time to time, till the quicksilver seems to diminish, and recover its natural form, but without dividing into small globules; after which the matter is to be washed, as all the silver is by that time completely taken up. The ores of *Verenguela de Pacages* are treated only with quicksilver and salt, and yield their full produce.

When the ore turns black, iron is added; when of a light lead-colour, tin; if a dark lead-colour, lead; and if of a yellowish or gold-colour, lime. The three first of these are styled, by Baron Born, "very idle and useless additions."—The ore frequently divides into small and powdery globules, in consequence of the hardness of the minerals, or from too much stirring; but this may be prevented by calcination before it is reduced to powder, or by less stirring. In a great many operations, however, this quicksilver dust can scarcely be avoided. It serves the workmen as an index of the progress they have made, or sometimes as a direction how to operate; and has different names according to the cause by which it is produced; as quicksilver dust, the dust of addition, and silver dust. The first of these arises simply from too great division, and is white without any quickness, scarcely moving when the matter is stirred with water; it sticks somewhat to the bottom, and runs into globules when broken between the fingers. The second is produced by the amalgam of lead and tin; and, when pressed between the fingers, unites with the quicksilver which had begun to combine with the silver. The third comes from the amalgam of silver: it sinks toward the coarser stuff on the bottom, and floats about in flakes of different sizes; turning into an amalgam when rubbed or pressed between the fingers. All of these are produced chiefly when there are lead, marcasite, and irony ores in the mixture; or by vitriol of copper, which is particularly productive of this minute division of the quicksilver. They are produced also by too plentiful an addition of salt, which thickens the water and prevents the descent of the particles of quicksilver.

According to the produce of the essay the large heap is regulated. It is first wetted with water, and mixed with a due proportion of salt; but at the beginning only one third of the quicksilver and one half of the lead and tin are added. It is turned over once every day during the two first days, because the quicksilver being then uncombined would be apt to be driven off in small globules, and a great waste occasioned. The heap is likewise too much cooled by the addition of too much quicksilver at once; so that it is better to put it gradually to the other matters. The lead and tin are always thrown into the heap along with the quicksilver; but too much of either is hurtful, by deadening the quicksilver, and preventing the amalgamation. All these additions, however, must vary according to circumstances; observing that the quantities added must always be less and less in proportion as the amalgam advances to perfection. The matter should be kept rather dry than otherwise, and two parts of amalgam be in the heap to one of fluid quicksilver. Too great an abundance of this fluid mass is very detrimental, on account of the quantity of quicksilver dust which it occasions; and if the other ingredients are accidentally wasted, the *dust of addition* will be changed into *quicksilver dust;* which having very little weight, will be poured off along with the water. But when lime is added, the whole must be mixed at once, and the entire heap turned over two or three days, till the quicksilver be added. Too much lime prevents the union of the two metals, and is an inconvenience which cannot be remedied.

The heaps are frequently turned and worked over after the first two days, which is attended with several advantages; as that the quicksilver is thus heated; more thoroughly mixed with the matter, and the silver is purified by the frequent rubbing. The heaps, however, are subject to various accidents, owing to the

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the difference between the various kinds of ores, which cannot always be exactly known. When the quickfilver is deadened by too large an addition of lead, iron, tin, or lime, it loſes its oval form, and aſſumes a vermicular one: if ſhaken in a glaſs, or other veſſel, without water, it adheres to the ſides in threads, and is unfit for taking up the ſilver. The beſt remedy is vitriol of copper, or the lixivium of vitriolic ores already mentioned; or powder of copper may be thrown into the heap. All additions of this kind, however, muſt be made very cautiouſly, and in conſequence of experiments made by ſmall eſſays, which determine the quantity of materials to be uſed. When the heaps have too much vitriol, without any correcting ingredient, the quickſilver has a leaden colour, and the ſmaller particles aſſume a ſpherical form. Iron might be added to abſorb the too great quantity of vitriolic acid; but there is no certain rule for the proportion to be added, ſo that it muſt be determined by experiment.

When the quickſilver appears, on turning the heaps like a bunch of grapes, this ſhows an exceſs of ſalt, which prevents the quickſilver from combining with the ſilver: it is to be remedied by the addition of ſome coarſe ſtuff which cleanſes the fluid. Some add aſhes: but the beſt and moſt natural remedy is alum, which is found at Potoſi in abundance, and whitens the ſilver. If the heap be not turned equally, or the quickſilver added at a proper time, or if the ſilver do not unite with it, ſome of the ſilver will appear in a dry form and lie on the coarſer ſtuff like a cobweb; and if not ſkimmed off in time will be carried away by the waſhing water. To collect this dry ſilver, and the fineſt quickſilver duſt, ſome ſilver amalgama is preſſed upon it through a chamois ſkin; and the whole is once more turned and worked over. The frequent turning, the heat of the climate and ſeaſon, as well as the fermentation produced in the heap by the vitriol and other additions, all promote the amalgamation; but cold, neglect of ſtirring, and the quickſilver aſſuming a lead colour, are againſt it. It is, however, very difficult to determine the maturity of the heap, when all the ſilver is taken up, and the matter may go to the waſhing; though great inconveniences attend an ignorance in this reſpect. If waſhed too ſoon, ſome ſilver is left in the leavings: and if worked too long there is a loſs of quickſilver as well as time and labour. The difficulties attending the knowledge of this important point, are by our author enumerated as follow: "The heap may appear not to require any additional quickſilver; the ſilver duſt may appear to be completely collected; that of quickſilver may begin to make its appearance: the amalgama may begin to appear pure, and to ſhow a gold-colour: and yet ſilver may remain in the leavings. The moſt infallible teſt of the maturity of the heap, is the eſſay of the triturated ſtuff by fire. If no ſilver is produced thereby, then ſo much quickſilver is thrown into the heap, that it may contain three parts of amalgama to two of ſilver, or at leaſt one part of quickſilver to two of amalgama. By this additional freſh quickſilver, all the duſt of quickſilver, and the dry and uncombined quickſilver, are perfectly collected the amalgama is the heavier for it, and ſinks the more readily to the bottom when brought to the waſhing-tub.— Some clean quickſilver is alſo put into the bottom of this tub: the inſide of which muſt be lined with iron plate well cleaned, and rubbed with quickſilver;" (though the laſt operation ſeems to be quite ſuperfluous, as mercury will not in the leaſt unite with iron by rubbing). "The ſtuff brought into the tub muſt be diluted with a great quantity of water, and be ſtirred round with a peſtle lined with iron-plate in ſuch a manner that it may turn round ſix times one way and ſix times the other, always touching the bottom; the unconnected bodies of quickſilver and amalgam are thereby to meet, to combine, and to fall to the bottom. To recover the ſalt which had been mixed with the heap, the water muſt be evaporated:" but the Baron obſerves, that at Shemnitz no ſalt is recoverable from the lixivium; and if any be recovered by the Spaniards, it only ſhows that they add too much, and that part of the remainder is undecompoſed by the vitriolic acid. The quickſilver is ſeparated from the amalgama much in the ſame way as already deſcribed.

2. *Amalgamation by boiling*, was accidentally diſcovered by Barba, in an attempt to fix quickſilver.— On mixing ſilver ore finely powdered with quickſilver, and boiling it with water in a copper veſſel, he found that the metals readily united; and thus having diſcovered a ſhorter method of amalgamation, he gradually improved and introduced it into practice in Peru. In this operation the boilers muſt be of copper, earthen or other veſſels being found not to anſwer: the copper alſo muſt be pure, becauſe the quickſilver would diſſolve the metals with which it is alloyed. They muſt be in the ſhape of inverted cones and flat-bottomed. The under part has a rim of ſix or eight inches high and half an inch broad, all beat of one piece. Other copper plates are fixed in the inſide with copper nails; and care muſt be taken that it be water-tight, that no quickſilver may run off; and for the better ſecurity, the inſide of the boiler may be lined with lime and ox-blood. The boilers may be of any magnitude; their upper parts being ſurrounded with iron rings with ſtrong handles, into which a croſs board is wedged. In the middle of this board is a hole for the ſpindle to move in. The ſpindle is of light wood, and moves on a braſs pivot in the bottom. It has four wooden wings, with three or four perpendicular bars alſo of wood; the fartheſt from the ſpindle being the ſhorteſt; the nigheſt ſo long as to ſweep the bottom. It is turned by a moveable handle on the upper end.

Theſe boilers are put into an oblong furnace, capable of holding 10 of them; the fire-place being in the middle, and the flame and ſmoke paſſing under the boilers, and going out on both ends of the furnace by two chimnies. The fire being lighted, firſt the water, then the fine ſtuff, and at laſt the quickſilver, is put in; obſerving always that the bottom be fully covered with quickſilver. The water muſt always be kept boiling, otherwiſe the operation may be interrupted or become tedious: on account of the evaporation, the boilers muſt be ſupplied with a quantity of water, in ſmall quantities at a time, that the boiling be not checked. The ſtuff muſt be proportioned to the ſize of the boiler: if too little be put in, the amalgamation goes on too ſlowly; while too much would not

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not allow the mass to be thick enough, or to boil with sufficient freedom. Some of the amalgam is to be taken out from time to time with a long ladle, and the progress of the operation is judged of by the colour. The essay of the stuff determines whether all the silver be taken out of it in this manner. Some quicksilver is then thrown upon the surface of a sample of the boiled stuff, and worked round with it in a vessel two or three times. If the quicksilver rises and takes up some of the stuff, some silver remains; if not the whole is taken up. Then the fire is stopped, the spindle is taken out, and the water and stuff let off. The coarser matter on the quicksilver may at all events be washed in cold water, and go once more to the mill. Almost the whole of the silver amalgama lies upon the surface of the quicksilver, immediately under the stuff, sometimes four or five fingers thick; the fire under the boilers preventing the silver from uniting with the quicksilver in the bottom. This metal, when poured off, must be pressed and treated in the usual manner.

The advantages attending this method are, that the heat promotes the union of the metals, while the boiling of the water and stirring of the mixture with the spindle bring them more frequently in contact with each other in a quarter of an hour, than they would be in several days in the common method; by which means the whole process is finished in about 24 hours. Less quicksilver is also lost by it; for being always covered with water, it cannot evaporate; and in well managed and successful operations, no quicksilver dust is produced: but the greatest recommendation is, that it is not attended with any loss of silver, so that even the poorest ores will yield all that they contain. Barba looks upon the profit of this method above the other to amount to 25 dollars for every heap of 50 quintals; even making allowance for the coals. The only objections are, that both silver and copper are apt to be lost by the corrosion of the copper-boilers: but if the copper be pure, there is no great reason to be apprehensive of any thing of this kind; or, at all events, the bottom of the boiler, which is constantly exposed to the action of the quicksilver, may be secured by a copper ring three or four inches high; and the bottom itself may be secured in the same manner; so that when corroded they may be changed for new ones: or the boilers may be paved or lined with varnishes or mortars of different kinds; which will as effectually prevent any loss. While the whole is boiling, the quicksilver violently seizes on the other metal; by which means the amalgam is filled with many heterogeneous particles. These are separated by washing in quicksilver, on the surface of which they swim like scoria, and may easily be taken off, till the quicksilver shows its usual brightness and as this cannot be done without taking off some of the metals also, the scum may be reserved for the next operation. The advantage of amalgamation by boiling chiefly appears in this, that heaps, in which by too large additions, the quicksilver has been totally dissolved so as to disappear, may be easily cured by boiling them, in iron or copper vessels with bits of iron; for then the quicksilver appears again in its proper metallic form and brightness.

3. *Amalgamation in mortars.* It is difficult to procure the full produce from ores which contain native gold and silver either in the form of hair or wire, or in larger lumps and nodules. These cannot be completely pounded, nor can they be amalgamated; for the mercury will not dissolve the large particles of gold and silver; and when they are treated by fire, the stubborn nature of their matrices occasions a great loss of metal. The following method of treating them in a mortar was discovered by a Franciscan friar.

A round conical hole is cut in a hard stone, half a foot in diameter at top, of an equal depth, and sloping into a truncated, or rather obtuse and nearly flat bottom, of about four inches in diameter. Some quicksilver is poured into it, together with a proportional quantity of small bits of the native metal or ore; after which they are triturated with an iron pestle. By this violent trituration, the gold and silver combine with the quicksilver; and the finer, lighter stuff of red silver ore and other silver calces, which are generally found with native silver, runs off by means of a small launder and current of water. It is not, however, suffered to run away, but is left to settle for common amalgamation.

Mortars of the dimensions above described being too small for any considerable quantity of ore, Barba proposes to substitute in their place larger stones of a concave figure, with vertical grinders, as in oil-mills; or common horizontal and parallel grinders of the grist-mill. The ore and quicksilver are put between these stones, with a small stream of water; which, running off, will carry away the lighter stuff, whilst the gold and silver will remain at the bottom, taken up by the quicksilver.

There are several other methods of amalgamation described in Baron Born's work, as practised by the Spaniards of South America: but as all of them agree in the most material circumstances with those already mentioned, we shall only farther take notice of that invented by the Baron himself, and by him lately introduced at Shemnitz in Lower Hungary.

This method is very pompuously related, and at great length, in his work on the subject. His theory contains the following particulars:

1. Quicksilver has a tendency to unite with other metals and semimetals, and to *quicken* or *animate* them according to certain laws of affinity which are determined by experience.

2. It unites with gold, silver, copper, tin, lead, bismuth, and zinc, without heat; but with other metals and semimetals it will not unite but in a state of fusion. It unites with tin and bismuth more easily than with gold and silver; and with these more readily than with copper.

3. The union of quicksilver with other metals is promoted by heat.

4. This union is also greatly promoted by mechanical comminution.

5. No amalgamation, or only a very slow and partial one will take place, if the surface of the quicksilver or metallic particles be covered with a coat of heterogeneous matter; which happens chiefly in the amalgamation of ores where the fine particles of the metal are involved in sulphur and arsenic.

6. Hence it is necessary to free the noble metals from

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from the ſtony matter which ſurrounds them, and to reduce the baſer ones from their calciform to a metallic ſtate, before they can be amalgamated with ſucceſs.

7. Particles of gold and ſilver may be freed from the ſtony matters which involve them by trituration; and from ſulphur and arſenic, by calcination.

8. In calcination, ſome part of the ſulphur is deſtroyed, and vitriolic acid diſengaged; which, combining with the earthy matters contained in the ore, as well as the calces of the baſer metals mixed with it, ſtill leave the gold and ſilver involved: whence it is neceſſary to employ ſuch chemical agents as will free the particles of theſe metals from their heterogeneous coat, and keep their ſurface as well as that of the quickſilver clean, without acting either upon the gold or ſilver. Theſe agents are principally the mineral acids, which act variouſly according to their different natures. The marine acid is moſt efficacious for gold or ſilver ores; but it would be exceedingly expenſive to uſe it in its proper form, ſo that it is neceſſary to take ſome method of expelling it extemporaneouſly from common ſalt by means of oil of vitriol.

9. The calcined ore, when pulveriſed, muſt be wetted with water, for the purpoſe of diſſolving the diſengaged vitriolic acid and the earthy and metallic neutral ſalts, which are produced by it in proportion to the ſulphur contained in the ore. Vitriol is produced by calcination only in this proportion; and hence if the ore does not naturally contain a ſufficiency of ſulphur to produce vitriol for the purpoſe of decompoſition, it will be neceſſary to add ſomething of this kind. Vitriol of copper or of iron will anſwer, but the former is preferable. If, therefore, the pulveriſed ore, which has once gone through the proceſs of amalgamation, ſhould ſtill appear to contain gold or ſilver, mix it with ſome additional vitriol and common ſalt; leave it for ſome time to macerate by itſelf; and, at a ſecond trituration with quickſilver, a conſiderable quantity of ſilver will be found in the amalgama which had not been extracted in the firſt, though common ſalt had been uſed in it. Thus the common ſalt may be decompoſed in the wet way.

10. To decompoſe the common ſalt in the dry way, the ore muſt be properly ſtamped and ſifted, and the mixtures made up with a proportional quantity of pulveriſed common or rock ſalt, and then undergo an adequate calcination in an open fire. Thus the common ſalt will be decompoſed according to the nature of the mixture; either by the vitriolic acid produced by the decompoſition of the ſulphur, or otherwiſe.—The muriatic acid, thus diſengaged, diſſolves the heterrogeneous particles in which the metals are involved, and allows the quickſilver to act upon them much more effectually than it could have been enabled to do by any mechanical comminution; and this the more ſo as it takes up even thoſe particles of dephlogiſticated iron upon which the other acids are incapable of acting.

11. The calcination and corroſion of the baſer metals is indiſpenſably neceſſary, eſpecially in a natural combination of gold and copper; for the affinity of theſe two is ſo ſtrong, that unleſs the latter be perfectly calcined, or otherwiſe removed, very little of the gold can be extracted. The ſeparation will alſo be promoted by the addition of ſulphureous ſubſtances.

From theſe conſiderations, the Baron lays down the following rules concerning amalgamation.

"1. The ores and mixtures previous to their amalgamation muſt be mechanically comminuted, and reduced to a fine powder, by ſtamping, grinding, and ſifting, that the ſurfaces of the particles, and their points of contact, may be increaſed and multiplied.

"2. This powder muſt be calcined, that, beſides the pure particles of the nobler metals, thoſe which are diſguiſed in the ore may be diſengaged and laid bare by deſulphuration and calcination.

"3. If before its calcination no common ſalt was added, it muſt be added afterwards; then it muſt be triturated with a proportionate quantity of quickſilver and water, long enough, and in ſuch a manner, that the quickſilver, by an unterrupted motion of the whole maſs, may come into repeated contact with the diſengaged gold and ſilver particles, and take them up.

"4. As much depends on the juſt-mentioned proportions, the inſpector, director, or maſter of the work, muſt be well acquainted with the elective attraction of bodies, that forming a juſt idea *of*, and judgment *on*, their different mechanical or chemical decompoſition and combination, he may remedy and remove ſuch untoward difficulties and impediments in the proceſs as may, and will ſometimes, prevent its full ſucceſs."

The various ſteps by which the metals are extracted from their ores, according to the Baron's method, are, 1. Stamping, grinding, and ſifting. 2. Calcination; after which the grinding and ſifting muſt be repeated. 3. Trituration. 4. Waſhing of the reſiduum. 5. Eliquation of the amalgama. 6. Heating of the ſame. 7. Diſtillation of the quickſilver preſſed from the amalgam. 8. Refining of the heated amalgam. 9. Extracting from the reſidua ſuch parts of the noble metals as may ſtill be contained in them.

1. *Stamping, grinding*, and *ſifting*. The Baron recommends dry ſtamps and mills for this purpoſe; as wet-ſtamps, he ſays, "would bring on great loſs of ſilver and expenſive contrivances to prevent or recover it." On the other hand, E. Raſpe, the tranſlator of his work, ſays, that "late experiments have proved ſo much in favour of the wet ſtamps, that they have actually been adopted as great improvements."

The contents of the ores are accurately inveſtigated by eſſays before any thing is done in the large way. The ores are delivered to the reſpective mills; the ſmaller ores are paſſed over a braſs ſieve, the meſhes of which are about one-tenth of an inch wide, that the finer particles may be ſeparated and not ſent to the ſtamps, which would occaſion ſome waſte, eſpecially in the dry way. The finer ſand is ſent directly to the mill, and the big lumps to the ſtamp. Each box, or ſet of ſtamps, has three ſtamp-heads, weighing 40 or 54 pounds, the ſole being of caſt-iron. The matter is every now and then wetted with water to prevent the finer parts from flying off. When the ore is ſufficiently beat in the ſtamps, it is afterwards ſifted, and the coarſe part returned to the ſtamp. When the coarſeſt part is reduced in this manner to the ſize of coarſe ſand, it is ſent to the mill; the running ſtone of which

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which must be kept close in a box, and nothing left open but the admission-funnel. The millstones are a kind of porphyry, and the sieves of brass-wire.

2. *Calcination.* The ore being reduced to a sufficient degree of fineness, is next carried to the calcining furnace; previous to which it is again to be tried by essay, and to have the proper additions according to its nature. When the furnace is properly heated, the whole quantity of ore destined to one furnace, about 30 quintals, is brought up to the top by wheel-barrows; and being spread as even as may be, the proper quantity of salt and lime is sifted over it; and the whole turned with crooks and rakes till it be perfectly mixed. The calcination is then performed in the following manner: The back-door being carefully shut, eight hundred weight of the matter, prepared as already mentioned, is let down through a funnel upon the upper hearth. Here is again to be spread and allowed to dry before it is put down on the lower hearth; and as soon as this is done, another quantity is put upon the upper hearth, that the two operations may regularly succeed each other.

Our author describes at great length all the minutiæ of this operation: but, as he justly observes, "Experience and practice are, and must be, the best teachers; for there are many things which must be attended to, and which words and descriptions will hardly make intelligible." We shall therefore only observe, that the calcining furnace must be kept heated day and night: but while the ore is shoved down from the upper to the lower hearth, the fire must be kept very moderate; and during the calcination it will be necessary to keep the matter constantly turning with iron rakes, the combs or teeth of which are from four to eight inches long.

The grinding and sifting after calcination is only necessary when the matter has run into hard indissoluble clots during the operation; and is performed in a grinding and sifting mill, which turns by water; but which is unnecessary here to describe, as every possessor of mines would choose such mechanical contrivances as best suit his purpose.

3. *Trituration, boiling,* and *amalgamation.* After the ores have been properly calcined and pounded, the success of the amalgamation depends mostly on the proportions of quicksilver and water which are added to the stuff, and the construction of the stirring apparatus by which the whole is kept in constant motion and mutual contact. The lighter the stuff, the more voluminous and bulky it will prove, and consequently the gold and silver will be more dispersed; in which case the quantity of quicksilver must be proportioned to the mass, that notwithstanding its constant gravitation towards the bottom it may the more frequently come in contact with the gold and silver. It acts in proportion to its bulk and surface. A larger quantity is therefore advisable, as it not only forms a larger surface on the bottom of the vessel, but comes likewise into contact with the gold and silver more frequently; nor is there any greater loss of quicksilver to be apprehended on that account. A larger proportion of fluid metal is in particular necessary when the matter it mixed with lead or antimony: for, by taking up the lead, it becomes proportionably less active and fit for the reception of gold and silver; and turning greasy by the antimony, it must in the former case leave rich residua, and in the latter bring on greater loss. It is also determined by experience, that the excess of quicksilver never does any hurt, while too small a quantity never fails to be disadvantageous.

With regard to the construction of the boilers, it is needless to be particular, as those recommended by Alonso Barba seem to be very adequate to the purpose. Heat is required; but it is not necessary that the matter should boil, a moderate fire being sufficient for making the metals unite. Nor is there occasion for more water than what will make the matter liquid. The stirring apparatus is put in motion by the crank of a water wheel, and a horizontal rack with cogs; which, being properly fixed in a groove by cross bars, slides forward and backward on brass rollers and castors. The cogs of this rack catch into those of the perpendicular trundle and spindle of the stirrers, which turns round twice by three and an half feet motion of the sliding rack. The whole moves quicker or slower in proportion to the box of water thrown upon the wheel; and the quicker motion of the rack produces of course a quick turn and better trituration. The stirrers must be circular segments corresponding with the sides and bottom of the boiler, otherwise their motion is irregular and unsatisfactory. The time of trituration, as depending on the nature of the ore, must be determined by experience.

4. *The washing of the triturated leavings or residuum* is performed in large tubs, and requires no particular description, farther than that it be continued till all the soluble matter be got out; and for this purpose there must be a contrivance for stirring the matter all the time it is washing.

5. *Eliquation of the quicksilver and amalgama.* Formerly this was performed in bags made of deer-skins, strongly compressed with engines for the purpose; but this being found too expensive, it is now done by small quantities at a time, and pressed only by the hand till the ball of amalgam yields no more quicksiver. A small quantity always remains in the quicksilver which passes through; and this quantity is the greater in proportion to the warmth of the amalgam when pressed.

6. The *distillation of the amalgam* is performed *per descensum* in large iron pots. The undermost stands upright to its middle in a stream of cold running water which passes under the hearth; the upper part hardly appearing two inches above it. The amalgam, made up into balls, is placed in iron cullenders fixed upon a tripod set in the bottom of the lower pot, and covered in the inside with a coarse cloth. The upper pot is inverted on the lower one; and the juncture being luted, the fire is put all round the outer one, and the heat passing through to the amalgam quickly liquefies it, and raises the quicksilver in vapour, which condenses in the under pot continually kept cool by the stream of water. The upper pot is kept in a strong red heat for five or six hours; by which means the cloth is entirely converted into tinder, so that the cullenders must afterwards be cleaned with a brass brush.

The other operations contain nothing particular but what may be easily understood from what has been already delivered.

Copper Ores.

Sect. IV. *Ores of Copper.*

§ 1. Copper is found under ground in three different forms: 1. Native or virgin copper diversely ramified, which is much more rare than native silver. This native copper is not so ductile as copper purified by fusions from the ore (A). 2. Copper is found in form of calx, of verdegrise, of precipitates. Such are the minerals called *silky copper ores*, and several white and green earths. These matters are only copper almost pure and but little mineralised, but which has been corroded, dissolved, precipitated, calcined by saline matters, by the action of the air, of water, and of earths (B). 3. Copper is frequently in a truly mineral state, that is, combined with sulphur and with arsenic, with other metallic matters mixed with earths, and enveloped in different matrices (C). These are the true copper ores. They have no regular forms except they partake of the nature of pyrites. Their colours are very different, which depend chiefly on the proportion of the mineral substances composing them. Lastly, in almost all of them we may perceive green or blue colours, which always indicate an erosion or calcination of the copper. Most copper ores contain also some iron or ferruginous earth, to which the ochrey colour is to be attributed, which might make us believe them to be ores of iron. Ores which contain much iron are the most difficultly fusible.

Copper ores have almost all a yellow, golden, and shining colour, by which they are easily distinguished. Some of them are coloured with irises, and frequently have spots of verdigrise, by which also they are distinguishable from other ores.

Many copper ores are also rich in silver. Such is that called the *white copper ore*, the colour of which is rather occasioned by arsenic than by silver, although it contains so much silver as to be enumerated by several mineralogists amongst silver ores.

Lastly, the pyrites of a golden yellow colour which contains copper and sulphur, and the white pyrites which contains copper and arsenic, are considered as copper ores by several chemists and naturalists. Henckel and Cramer remark, that no proper ore of copper is known which does not contain a considerable quantity of arsenic.

Essaying of Ores of Copper.

§ 2. *Ores of copper* may be *essayed* in methods similar to those employed for smelting of large quantities of ores (Part III.), or they may in general be essayed by the following processes.

PROCESS I.

To reduce and precipitate copper from a pure and fusible ore in a close vessel.

"Mix one, or, if you have small weights, two docimastical centners of ore beat extremely fine, with six centners of the black flux; and having put them into a crucible or pot, cover them one inch high with common salt, and press them down with your finger: but let the capacity of the vessel be such that it may be only half full; shut the vessel close, put it into the furnace; heap coals upon it, so that it may be covered over with them a few inches high; govern the fire in such a manner that it may first grow slightly red-hot. Soon after you will hear your common salt crackle; and then there will be a gentle hissing noise. So long as this lasts, keep the same degree of fire till it is quite over. Then increase suddenly the fire, either with the funnel and cover put upon the furnace, or with a pair of bellows applied to the hole of the bottom part, that the vessel may grow very red-hot. Thus you will reduce and precipitate your copper in about a quarter of an hour: then take out the vessel, and strike with a few blows the pavement upon which you put it, that all the small grains of copper may be collected in one mass.

"Break the vessel, when grown cold, in two, from top to bottom, as nearly as you can: if the whole process has been well performed, you will find a solid, perfectly yellow and malleable regulus adhering to the bottom of the vessel, with scorias remaining at top of a brown colour, solid, hard, and shining, from which the regulus must be separated with several gentle blows of a hammer; this done, weigh it, after having wiped off all the filthiness.

A soft, dusty, and very black scoria, is a sign of a fire not sufficiently strong. Small neat grains of copper,

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(A) *Native copper* is solid; or consisting of friable masses, formed by precipitation of cupreous vitriolic waters called *cement* or *ziment copper*; or forming crystallized cubes or grains, leaves, branches, or filaments.

(B) *Calciform ores* are either pure calces of copper, or are mixed with heterogeneous matters. 1. The *pure* or loose friable ochre, called *cæruleum montanum* "mountain-blue," and *viride montanum* "mountain-green;" and the *red indurated calx*, called improperly *glass copper ore*. 2. *Mixed* calciform ores are those in which the calx of copper is mixed; with *calcareous earth*, forming a mountain-blue; with *iron*, forming a black calx; with *gypsum*, an indurated green ore, called *malachites*; and with *quartz*, a red ore.

(C) Copper is *mineralised*, 1. By *sulphur*, forming the *grey copper ore*, improperly called *vitreous* (minera cupri vitrea Wallerii). 2. By *sulphurated iron*, forming the *hepatic copper ore* (minera cupri hepatica Wallerii) of a brown yellow colour. It is a kind of cupreous pyrites, and is called by Cronstedt *minera cupri pyritacea*. Sometimes it is of a blackish grey colour, and is then called *pyrites cupri griseus* (minera cupri grisea Wallerii); sometimes of a reddish yellow, and tarnished with blue irises on its surface, when it is called *minera cupri lazurea*; when of a yellowish green colour, it is the *pyrites cupri flavo-viridescens* (cuprum sulphure et ferro mineralisatum Wallerii); and when of a pale yellow colour, it is the *pyrites cupri pallidé flavus*. Most of the above piritaceous ores contain also some arsenic, but their sulphur is predominant. 3. *Copper mineralised by sulphur, iron, and arsenic. White copper ore* (Minera cupri alba Wallerii). This ore contains also some silver. 4. *Copper dissolved by vitriolic acid. Native blue vitriol.* 5. *Copper united with bitumen. Copper coal ore.* This is a pit coal, from the ashes of which copper is obtainable. 6. Copper is also found in the mineral called *kupfer nickel*.

per reduced but not precipitated, and adhering still to scorias, especially not very far from the bottom, and an unequal and ramificated regulus, are signs of the same thing. A solid, hard, shining, red-coloured scoria, especially about the regulus, or even the regulus itself when covered with a like small crust, are signs of an excess in the degree and duration of the fire.

"*Remarks.* All the ores which are easily melted in the fire are not the objects of this process; for they must also be very pure. Such are the vitreous copper ores." (Mr Cramer means, it is presumed, the red calciform ore, called improperly *glass ore*, and not the *minera cupri vitrea* of Wallerius, which being composed of copper mineralised by sulphur could not be treated properly by this process, in which no previous roasting is required. The sulphur of this ore would with the alkali of the black flux form a hepar, from which the metal would not precipitate). "But especially the green and azure-coloured ores, and the *cæruleum* and *viride montanum*, which are not very different from them. But if there is a great quantity of arsenic, sulphur, or the ore of another metal and semimetal joined to the ore of copper, then you will never obtain a malleable regulus of pure copper, tho' ores are not always rendered refractory by the presence of these."

PROCESS II.

To reduce and precipitate copper out of ores rendered refractory by earth and stones that cannot be washed off.

"Beat your ore into a most subtile powder, of which weigh one or two centners, and mix as much sandiver to them. This done, add four times as much of the black flux with respect to the ore; for by this means, the sterile terrestrial parts are better disposed to a scorification, and the reducing and precipitating flux may act more freely upon the metallic particles freed from all their incumbrances.

"As for the rest, make the apparatus as in last process: but you must make the fire a little stronger for about half an hour together. When the vessel is grown cold and broken, examine the scorias, whether they are as they ought to be. The regulus will be as fine and ductile as the foregoing.

"*Remarks.* As these copper ores hardly conceal any sulphur and arsenic in them, the roasting would be of no effect, and much copper would be lost. For no metallic calx, except those of gold and silver, improperly so called, can be roasted, without you find a part of the metal lost after the reduction."

PROCESS III.

To precipitate copper out of an ore (D) *that contains iron.*

"Do all according to last process. But you will find after the vessel is broken, a regulus upon no account so fine, but less ductile, wherein the genuine colour of the copper does not perfectly appear, and which must be further purified.

"*Remarks.* The fire used in this operation is not so strong that the iron should turn to a regulus. But as copper is the menstruum of iron, which is of itself very refractory in the fire; for this reason, while the ore and the flux are most intimately mixed and confounded by trituration, the greatest part of the iron being dissolved by the copper, turns into a regulus along with it."

PROCESS IV.

The roasting of a pyritose, sulphureous, arsenical, semimetallic, copper ore.

"Break two docimastical centners of the ore to a coarse powder, put them into a test covered with a tile, and place them under the muffle of a docimastical furnace. But the fire must be so gentle, that the muffle may be but faintly red-hot. When the ore has decrepitated, open the test and continue the fire for a few minutes; then increase it by degrees, that you may see the ore perpetually smoking a little: in the mean time, it is also proper now and then to stir it up with an iron hook. The shining particles will assume a dark red or blackish colour. This done, take out the test, that it may grow cold. If the small grains are not melted, nor strongly adherent to each other, hitherto all will be well; but if they run again into one single cake, the process must be made again with another portion of the ore, in a more gentle fire.

"When the ore is grown cold, beat it to a powder somewhat finer, and roast it by the same method as before; then take it out, and if the powder is not melted yet beat it again to a most subtile powder; in this you are to take care that nothing be lost.

"Roast the powder in a fire somewhat stronger, but for a few minutes only. If you do not then find the ore any way inclined to melt, add a little tallow and burn it away under the muffle, and do the same another time again, till, the fire being very bright, you no longer perceive any sulphureous, arsenical, unpleasant smell, or any smoke; and there remains nothing but a thin, soft powder, of a dark red, or blackish colour.

"*Remarks.* Every pyrites contains iron, with an unmetallic earth; to which sulphur or arsenic, and most commonly both, always join. Besides, there is copper in many pyrites; but sometimes more and sometimes less: some of them are altogether destitute of copper; therefore, so much as pyrites differ with regard to the proportion of their constituent particles so much do they differ as to their disposition in the fire. For instance, the more copper there is in pyrites, the more it inclines to colliquation. The more sulphur and arsenic it has in it, the more quickly the melting of it will be procured, and the reverse: the more iron and unmetallic earth it contains, the more it proves refractory in the fire. Now if such pyrites melt in the roasting, as happens to some of them if they grow but red-hot, the sulphur and arsenic that lies hidden therein are so strictly united with the fixed part, that you would in vain attempt to dissipate them. Nay,

(D) Mr Cramer still means the calciform ores only, and not the mineralised ores of copper.

Nay, in this case, when it is reduced again into a powder it requires a much greater time and accuracy in the regimen of the fire to perform the operation. For this reason, it is much better to repeat it with new pyrites. But you can roast no more than the double quantity at once of the ore you have a mind to employ in the foregoing experiment; to the end that, the precipitation by fusion not succeeding, there may remain still another portion entire; lest you should be obliged to repeat a tedious roasting. If you see the signs of a ferreous refractory pyrites, the operation must be performed with a greater fire, and much more quickly. However, take care not to do it with too violent a fire: for a great deal of copper is consumed not only by the arsenic, but also by the sulphur; and this happens even in vessels shut very close, when the sulphur is expelled by a fire not quite so strong; which a reiterated and milder sublimation of the sulphur in a vessel both very clean and well closed will clearly show.

"When the greatest part of the sulphur and the arsenic is dissipated by such causes as promote colliquation, you may make a stronger fire: but then it is proper to add a little of some fat body; for this dissolves mineral sulphur: it changes the mixture of it in some part, which, for instance, consists in a certain proportion of acid and phlogiston; and at the same time hinders the metallic earth from being reduced into copper, by being burnt to an excess. From these effects, the reason is plain why assayers produce less metal in the trying of veins of copper lead, and tin, than skilful smelters do in large operations. For the former perform the roasting under a muffle, with a clear fire, and without any oily reducing menstruum; whereas the latter perform it in the middle of charcoal or of wood, which perpetually emit a reductive phlogiston.

"The darker and blacker the powder of the roasted ore appears, the more copper you may expect from it. But the redder it looks, the less copper and the more iron it affords; for roasted copper dissolved by sulphur or the acid of it is very black, and iron, on the contrary, very red.

PROCESS V.

The precipitation of copper out of roasted ore of the last process.

"Divide the roasted ore into two parts: each of them shall go for a centner: add to it the same weight of sandiver, and four times as much of the black flux, and mix them well together. As for the rest, do all according to the process I: the precipitated regulus will be half malleable, sometimes quite brittle, now and then pretty much like pure copper in its colour, but sometimes whitish, and even blackish. Whence it is most commonly called *black copper*, though it is not always of so dark a dye.

"It is easy to conceive, that there is as great a difference between the several kinds of that metal called *black copper*, as there is between the pyritose and other copper ores accidentally mixed with other metallic and semi-metallic bodies. For all the metals, the ores of which are intermixed with the copper ores being reduced, are precipitated together with the copper which is brought about by means of the black flux. Wherefore iron, lead, tin, the reguline part of antimony, bismuth, most commonly are mixed with black copper in a multitude of different proportions. Nay, it is self-evident, that gold and silver, which are dissolvable by all these matters, are collected in such a regulus when they have been first hidden in the ore. Besides, sulphur and arsenic are not always altogether absent. For they can hardly be expelled so perfectly by the many preceeding roastings, but there remain some vestiges of them, which are not dissipated by a sudden melting, especially in a close vessel, wherein the flux swimming at top hinders the action of the air. Nay, arsenic is rather fixed by the black flux, and assumes a reguline semi-metallic form, while it is at the same time preserved from dissipating by the copper.

PROCESS VI.

To reduce black copper into pure copper by scorification.

"Separate a specimen of your black copper, of the weight of two small docimastical centners at least; and do it in the same manner, and with the same precautions, as if you would detect a quantity of silver in black copper.

"Then with lute and coal-dust make a bed in the cavity of a test moistened: when this bed is dry, put it under the muffle of the docimastical furnace, in the open orifice of which there must be bright burning coals, wherewith the test must likewise be surrounded on all parts. When the whole is perfectly red-hot, put your copper into the fire, alone, if it contains lead; but if it is altogether destitute of it, and a small quan- of glass of lead, and with a pair of hand-bellows increase the fire, that the whole may melt with all speed: this done, let the fire be made a little violent, and such as will suffice to keep the metallic mass well melted, and not much greater. The melted mass will boil, and scorias will be produced, that will gather at the circumference. All the heterogeneous matters being at last partly dissipated, and partly turned to scorias, the surface of the pure melted copper will appear. So soon as you see it, take the pot out of the fire, and extinguish it in water: then examine it in a balance; and if lead has been at first mixed with your black copper, add to the regulus remaining of the pure copper one 15th part of its weight which the copper has lost by means of the lead, then break it with a vice; and thus you will be able to judge by its colour and malleability, and by the surface of it after it is broken, whether the purifying of it has been well performed or no. But whatever caution you may use in the performing of this process, the product will nevertheless be always less in proportion than what you can get by a greater operation, provided the copper be well purified in the small trial.

"*Remarks.* This is the last purifying of copper, whereby the separation of the heterogeneous bodies begun in the foregoing process is completed as perfectly as it possibly can be. For, except gold and silver, all the other metals and semimetals are partly dissipated and partly burnt, together with the sulphur and arsenic. For in the fusion they either turn of themselves to scoria or fumes, or this is performed by means of iron,

Essaying of Ores of Copper.

iron, which chiefly absords semimetals, sulphur, and arsenic, and the destruction of it is at the same time accelerated by them. Thus the copper is precipitated out of them pure; for it is self-evident, that the unmetallic earth is expelled, the copper being reduced from a vitrescent terrestial to a metallic state, and the arsenic being dissipated by means of which the said earth has been joined to the coarser reguluses of the first fusion. But there is at the same time a good quantity of copper that gets into the scorias: however, a great part of it may be reduced out of them by repeating the fusion.

"The fire in this process must be applied with all imaginable speed, to make it soon run: for if you neglect this, much of your copper is burnt; because copper that is only red-hot, cleaves much sooner, and in much greater quantity, into half-scorified scales, than it is diminished in the same time when melted. However, too impetuous a fire, and one much greater than is necessary for the fusion of it destroys a much greater quantity of it than a fire sufficient only to put it in fusion would do. For this reason, when the purifying is finished, the body melted must be extinguished in water together with the vessel, lest, being already grown hard, it should still remain hot for a while; which must be done very carefully to prevent dangerous explosions.

"The scoria of the above process frequently contains copper. To extract which, let two or three docimastical centners of the scoria, if it be charged with sulphur, be beat to a subtile powder, and mix it, either alone, or if its refractory nature requires it, with some very fusible common pounded glass without a reducing saline flux, and melt it in a close vessel, and in a fire having a draught of air; by which you will obtain a regulus.

"But when the scoria has little or no sulphur at all in it, take one centner of it, and with the black flux manage it as you do the fusible copper ore, (process I.) by which you will have a pure regulus."

PROCESS VII.

The following process is translated from Mr Gellert's *Elements of Essaying*, and describes a new method of essaying ores, concerning which, see the section *Of Essaying in general*, p. 338. col. 2.

To essay copper ores.

Roast a quintal of ore [in the manner described in process IV.]: add to it an equal quantity of borax, half a quintal of fusible glass, and a quarter of a quintal of pitch: put the mixture in a crucible, the inner surface of which has been previously rubbed with a fluid paste of charcoal-dust and water: cover the whole with pounded glass mixed with a little borax, or with decrepitated sea-salt: put a lid on the crucible, which you will place in an air-furnace, or in a blast-furnace: when the fire shall have extended to the bottom of the coals, let it be excited briskly during half an hour, that the crucible may be of a brisk red colour: then withdraw the crucible, and when it is cold break it: observe if the scoria be well made: separate the regulus, which ought to be semi-ductile; and weigh it. This regulus is black copper; which must be purified, as in process VI.

If the ore be very poor, and inveloped in much earthy and stony matters; to a quintal of it, a quintal and a half of borax, a quarter of a quintal of pitch, and ten pounds of calx of lead or minium, must be added. The calx of lead will be revived, and will unite with the scattered particles of the copper, and together with these will fall to the bottom of the crucible, forming a compound regulus. When the ores of copper are very rich, half a quintal of borax and a quarter of a quintal of glass will be sufficient for the reduction. If the ore is charged with much antimony, a half or three quarters of a quintal of clean iron-filings may be added; otherwise the large quantity of antimony might destroy the copper, especially if the ore contained no lead. If iron be contained in copper ore, as in pyrites, some pounds of antimony, or of its regulus, may be added in the essay; as these substances more readily unite with iron than with copper, and therefore disengage the latter metal from the former.

PROCESS VIII.

To essay ores of copper by humid solution.

Some pyrites and ores contain so small a quantity of copper, that it cannot be separated by the above processes, but is destroyed by the repeated roastings and fusions. These, and indeed any copper-ores, may be essayed by humid solution, or by menstruums.

1. By roasting a sulphureous ore, the sulphur is burnt or decomposed, its phlogiston with part of the acid evaporating, while the remaining part of the acid combines with the metals, especially with the copper and iron contained in the ore. Accordingly, from an ore thus roasted, a vitriolic solution may be obtained by lixiviation with warm water, especially if the ore has been exposed, during a few days after it has been roasted, to a moist air; as the water thus gradually applied unites better with the combination of the metallic calxes with the concentrated vitriolic acid of the sulphur: but all the copper is not thus reduced by one operation to a vitriol. More sulphur must therefore be combined with the residuous ore by fusion, and must be again burnt off, that the remaining part of the copper may be attacked by some of the acid of the sulphur. By repeating this operation, almost all the copper and iron will be reduced to a vitriolic lixivium, from which the copper may be separated and precipitated by adding clean pieces of iron.

2. Copper-ores may be more easily essayed by humid solution in the following manner:

Roast the mineralised ores in the manner directed in Process IV. and pulverise them. If the ores be calciform, they do not require a previous roasting. Put this powder into a matrass capable of containing ten times the quantity of the ore; pour upon the ore some water: set the matrass in a sand-bath, that the water may boil: pour off the lixivium: add to the residous ore more water, with some vitriolic or marine acid: digest as before in the sand-bath, and add this lixivium to the former: repeat this operation, till you find that the acid liquor dissolves no more metal.

By adding clean plates of iron you may precipitate the copper, which ought then to be collected, fused with a little borax and charcoal dust, and weighed.

Effaying of Ores of Copper.

We may remark, that although copper is not soluble by a dilute vitriolic acid, yet the calx of it obtained by roasting the ore, and also the calciform ores, are readily soluble in that acid.

3. Stahl advises to essay copper ores by boiling them, after they have been roasted and powdered, in water, together with tartar and common salt, or with alum and common salt: but we have not found this method so effectual as the preceding.

PROCESS IX.

Dr Fordyce's method of essaying copper ores, by means of aqua regia. [Phil. Trans. for 1781, vol. lxxx. art. 3.]

THIS method consists only in pouring a quantity of an aqua regia composed of equal parts of the nitrous and muriatic acids upon a small quantity of the ore in powder, till a fresh affusion of the menstruum shows no green or blue tinge; by which means all the metalline part of the ore will be dissolved. It is then to be precipitated by means of a solution of fixed alkali, or volatile alkali cautiously managed will answer the same purpose. The metal then appears in form of a green precipitate called *green verditer;* but is mixed with what calcareous earth might have been contained in the ore; which the acids would dissolve, and the fixed alkali, if that kind was used, would precipitate. The caustic volatile alkali would not throw down this earth, and is therefore to be preferred to any other; but care must be taken to hit the point of saturation very exactly with it, as it violently dissolves the metal if added in too great quantity. Dr Fordyce orders this green calx to be dissolved in vitriolic acid, and then, by adding a piece of clean iron to the solution, all the copper contained in the ore will be obtained in its metallic form.

This method can be subject to no fallacy, unless the ore contains a luminous matter; in which case some of the earth of alum will be mixed with the metal, as that earth will be precipitated by fixed alkali, by caustic volatile alkali, and by iron. This, however, may very effectually be prevented by dissolving the green calx first in volatile alkali, and then in vitriolic acid. It is even probable, that by reducing the ore to a very fine powder, and treating it with caustic alkali, all the metal might be separated from the ore, without the trouble of using aqua regia. For the principles on which this method is conducted, see the article CHEMISTRY *passim*.

Ores of Lead.

SECT. V. *Ores of Lead.*

§ 1. LEAD is seldom found native (E) and malleable. Neither, says Mr Macquer (F), is it found in form of calx or precipitate, as copper is, because it is much less liable to lose its phlogiston by the action of air and water: therefore almost all lead is found naturally mineralised.

Lead is generally mineralised by sulphur (G). Its ores have a dark white, but a shining metallic colour. These ores, although they form irregular masses, are internally regularly disposed, and seem to be composed of cubes of different sizes applied to each other, but not adherent. These ores are generally distinguished by the name of *Galena*. They commonly contain about three quarters of lead and a quarter of sulphur. They are accordingly heavy and fusible, although much less so than pure lead.

Most lead-ores contain silver; none but those of Willach in Corinthia are known to be quite free from it: some of them contain so much of it, that they are considered as improper ores of silver. The smaller the cubes of galena are, the larger quantity of silver has been remarked to be generally contained.

§ 2. *Lead ores may be essayed,* 1. By means of the black flux, in the manner directed by Mr Cramer, as follows:

"Let one or more quintals of this ore be grossly powdered, and roasted in a test till no more sulphureous vapours be exhaled, and then reduced to a finer powder; it is then to be accurately mixed with twice its weight of a black flux, a fourth part of its weight of clean filings of iron and of borax. The mixture is to be put into a good crucible, or rather into a test; it is then to be covered with a thickness of two or three fingers of decrepitated sea-salt; the crucible is to be closed, and placed in a melting furnace, which is to be filled with unlighted charcoal, so that the top of the crucible shall be covered with it. Lighted coals are then to be thrown upon the unkindled charcoal, and the whole is left to kindle slowly, till the crucible be red-hot; soon after which a hissing noise proceeds from the crucible, which is occasioned by the reduction of the lead: the same degree of fire is to be maintained while this noise continues, and is afterwards to be suddenly

(E) Cronstedt doubts whether any native lead has been found. Linnæus says, he has seen what externally appeared to be such.

(F) But he is mistaken. As lead unites strongly with vitriolic acid, we might expect to meet ochres of this metal as well as of copper. Accordingly we find some calciform ores of lead. 1. A pure calx of lead, in form of a friable ochre, *cerussa nativa*, found on the surface of galena; or it is indurated with a radiated or fibrous texture, of a white or yellowish green colour, and resembling spar; it is called *spatum plumbi*, *sparry lead-ore*, and *lead-spar*. 2. A calx of lead is found mixed with calx of arsenic, forming the ore called *arsenicated lead-spar*. Sometimes also that calx is mixed with calcareous earth.

(G) Lead is mineralised, 1. With sulphur; such are the several kinds of steel-grained and tessellated galenas, which also contain generally some silver. 2. With sulphurated iron and silver. It is fine-grained or tessellated, and is distinguished from the former by yielding a black slag when scorified, whereas the former yields a yellow slag. 3. With sulphurated antimony and silver. *Plumbum stibiatum Linnæi.* Its colour is similar to that of galena, and its texture is striated. 4. With sulphur and arsenic. This ore is soft, almost malleable, like lead. From this ore lead may be melted by the flame of a candle.

Ores of Tin

denly increased, so as to make a perfect fusion; in which state it is to be continued during a quarter of an hour; after which it is to be extinguished; and the operation is then finished." The filings of iron are added to the mixture to absorb the sulphur; a certain quantity of which generally remains united with the lead-ore, notwithstanding the roasting. We need not fear lest this metal should unite with the lead and alter its purity; because, although the sulphur should not hinder it, these two metals cannot be united. The refractory quality of the iron does not impede the fusion; for the union it forms with the sulphur renders it so fusible, that it becomes itself a kind of flux. This addition of iron in the essay of lead-ores would be useless, if the ores were sufficiently roasted, so that no sulphur should remain.

Or, 2. By the following process of Mr Gellert.

"Mix a quintal of roasted lead-ore with a quintal of calcined borax, half a quintal of glass finely pulverised, a quarter of a quintal of pitch, and as much of clean iron-filings: put this mixture into a crucible wetted with charcoal-dust and water: place the crucible before the nozzle of the bellows of a forge, and when it is red raise the fire during 15 or 20 minutes; then withdraw the crucible, and break it when cold."

Some very fusible ores, such as the galena of Derbyshire, may be essayed, as large quantities of it are smelted, without previous roasting, and without addition, merely by fusion during a certain time. For this purpose nothing more is requisite than to keep the ore melted in a crucible with a moderate heat, till all the sulphur is destroyed, and the metal be collected. To prevent the destruction of any part of the metal after it is separated from the sulphur, some charcoal dust may be thrown over the ore, when put into the crucible: but if the galena be mixed with pyrites, especially arsenical pyrites, it requires much roasting and saline fluxes.

Sect. VI. *Tin Ores.*

§ 1. Tin is very seldom found pure, but almost always mineralised, and chiefly by arsenic.

The richest ore of tin is of an irregular form, of a black or tarnished colour, and almost the heaviest of all ores. The cause of this extraordinary weight is, that it contains much more arsenic than sulphur, whereas most ores contain more sulphur than arsenic.

The most common tin ore is of the colour of rust, which proceeds from a quantity of iron or of iron-ore mixed with it. The tin-ores of Saxony and Bohemia appear to be all of this kind.

One kind of tin-ore is semi-transparent and like spar. Lastly, several kinds of garnets are enumerated by mineralogists among tin-ores, because they actually contain tin.

The county of Cornwall, in England, is very rich in tin-ores; and the tin contained in them is very pure. From tin-mines in the East Indies tin is brought, called *Malacca tin*. No mines of tin have been discovered in France; only in Bretagne garnets are found which contain some tin.

Native tin is said to have been found in Saxony and Malacca. Its ores are all of the calciform kind, excepting black-lead, which appears to be tin mineralised by sulphur and iron.

Ores of Iron

The calciform ores of tin are, 1. Tin-stone, which is of a blackish-brown colour, and of no determinate figure; and tin-grains, or crystals of tin, which resemble garnets, and are of a spherical or polygonal figure, which they have probably acquired by the attrition of their angles. The tin-stone seems to consist of attrited tin-grains. This ore is calx of tin united with calx of arsenic, and frequently with calx of iron. 2. Garnets are said to contain calx of tin united with calx of iron. 3. Manganese is said also to contain tin.

§ 2. *Ores of tin may be essayed* in the same manner, according to Cramer, as he directed for the essay of lead-ores, *supra*. He further makes upon this essay the following remarks.

1. Tin-ore, on account of its greater gravity, admits better of being separated, by elutriation or washing, from earths, stones, and lighter ores. 2. A most exact separation of earths and stones ought to be made, because the scorification of these by fluxes require such a heat as would destroy the reduced tin. 3. The iron ought to be separated by a magnet. 4. By a previous roasting, the arsenic is dissipated, which would otherwise carry off a great deal of tin along with it in a melting heat, would change another part of it into ashes, and would vitiate the remaining tin. 5. The essay of tin is very precarious and uncertain; because tin once reduced is easily destructible by the fire, and by the saline fluxes requisite for the reduction.

Mr Gellert directs, that ores of tin should be essayed in the following manner:

"Mix a quintal of tin-ore, washed, pulverised, and twice roasted, with half a quintal of calcined borax, and half a quintal of pulverised pitch: these are to be put into a crucible moistened with charcoal-dust and water, and the crucible placed in an air-furnace; after the pitch is burnt, give a violent fire during a quarter of an hour; and then withdraw your crucible. If the ore be not very well washed from the earthy matters, as it ought to be, a larger quantity of borax is requisite, with some powdered glass, by which the too quick fusion of the borax is retarded, and the precipitation of the earthy matters is prevented. If the ore contains iron, to the above mixture may be added some alkaline salt.

Sect. VII. *Ores of Iron.*

§ 2. Iron is seldom found in its metallic state, and free from admixture; though Cramer gives an account of an ore which needs only to be put into a forge, and heated to a welding heat. Several sands and earths also have the appearance of iron, and are even attractable by a magnet. The ore mentioned by Cramer is found vitrefied: with moderate blows the scorias are thrown out, and a mass of iron obtained, which, by being put into the forge again, gives tough iron without any other process. But in general this metal is found in the state of a calx; or, though it is combined with a great quantity of the principle of inflammability, it has seldom enough of the metallic form; and it is very often intermixed with a certain proportion of sulphur. The minerals wrought for iron are three, *viz.* iron ore, iron-stone, and bog-ore.

Ores of Iron.

The iron ore is found in veins as the ores of other metals are, and the appearance is very various; sometimes it has a rusty iron colour resembling that of iron; sometimes it has a reddish cast; often it is formed into a sort of crystallizations which are protuberant knobs on the outside; and these consist of fibres tending to a common centre: and it is of a dark colour like coagulated blood. It is called *hæmatites* or *blood-stone*; and consists of a calx of iron with a small quantity of vitriolic acid.

Iron-stone in Britain is clay found in strata with coal: but which contains a large quantity of iron, so as to make the working profitable. Sometimes it has little appearance of iron; but when burnt with a certain degree of heat, it becomes of a deep red.

The bog-ore is an ochre of iron, and is found generally in low situations, and in springs containing a small quantity of iron, which flowing over these grounds deposits it in the form of ochre; and after a number of ages it proves a rich mine of iron, and it is extracted from a calx of this kind in many parts of the world. There is also a particular kind of spar found in different countries of a pale blue colour, so that from its first appearance we would expect copper; but it contains a small quantity of iron, and is a combination of the metal with inflammable matter, as in Prussian blue.

The loadstone is a noted iron ore. It is always found in veins, and it is alledged that it is only possessed of its magnetic qualities when near the surface. In appearance, it does not differ from many of the ores of iron, and treated as an ore, it affords a considerable quantity of metal.

Neither is iron generally mineralised so distinctly as other metals are, unless in pyrites and ores of other metals.

Most of the minerals called *iron ores* have an earthy, rusty, yellowish, or brownish appearance, which proceeds from the facility with which the true iron ores are decomposed.

Iron is the most common and most abundant of all metals. In Europe, at least, we cannot find an earth, a sand, a chalk, a clay, a vitrifiable or calcinable stone, or even the ashes of any substance, which do not contain an earth convertible into iron. All earths and stones which are naturally yellow or red, and all those which acquire these colours by calcination, receive them from the ferruginous earth mixed with them. The yellow and red ochres consist almost solely of this earth: the black and heavy sands are generally very ferruginous.

The iron ore most commonly found is a stone of the colour of rust, of an intermediate weight betwixt those of ores in general and of unmetallic stones. This ore has no determinate form, and easily furnishes an iron of good quality.

Blood-stone or hematites, sanguine or red-chalk, and emery, are iron ores; some of which, for instance blood-stone, are almost all iron. Most of these substances require but a slight calcination to be rendered very attractable by a magnet, and soluble in aqua-fortis; but the iron obtained form them is of a bad quality, and they are therefore neglected. Iron from the hematites is very brittle; that obtained from ochres is red-short. All these iron ores are so refractory, that they can scarcely be fused.

Iron ores are very various in their form; or rather they have no determinate form. Sometimes they are earths, sometimes stones, sometimes grains. Accordingly, those naturalists who attend only to the external form of things in classing and subdividing minerals, have been obliged to multiply the names of iron ores; hence they are called *iron ores in form of pease, of beans, of coriander seeds, of pepper-corns, of cinnamon*, &c. which Mr Cramer treats as ridiculous trifles.

Essaying of Ores of Iron.

§ 2. *Ores of iron may be essayed* by the following process:

PROCESS I.

[*Cramer's Art of Assaying*, Proc. 54.]

To reduce a precipitate iron out of its ore in a close vessel.

"Roast for a few minutes in a test under a muffle, and with a pretty strong fire, two centners of the small weight of your iron ore grossly pulverised; that the volatiles may be dissipated in part, and the ore itself be softened in case it should be too hard. When it is grown cold, beat it extremely fine, and roast it a second time, as you do the copper-ore, but in a much stronger fire, till it no longer emits any smell; then let it grow cold again. Compose a flux of three parts of the white flux, with one part of fusible pulverised glass, or of the like sterile unsulphureous scorias, and add sandiver and coal-dust, of each one-half part; add of this flux three times the quantity of your roasted ore and mix the whole very well together; then choose a very good crucible, well rubbed with lute within, to stop the pores that may be here and there unseen; put into it the ore mixed with the flux; cover it over with common salt; and shut it close with a tile, and with lute applied to the points.

"Put the wind-furnace upon its bottom-part, having a bed made of coal-dust. Introduce besides into the furnace a small grate supported on its iron bars, and a stone upon it, whereon the crucible may stand as on a support: surround the whole with hard coals, not very large, and light them at top. When the vessel begins to grow red, which is indicated by the commons salt's ceasing to crakle, stop with gross lute the holes of the bottom part, except that in which the nozzle of the bellows is received: blow the fire, and excite it with great force, adding now and then fresh fuel, that the vessel may be never naked at top; having thus continued your fire in its full strength for three quarters of an hour, or for a whole hour, take next the vessel out of it, and strike several times the pavement upon which it is set, that the small grains of iron which happen to be dispersed may be collected into a regulus, which you will find after having broken the vessel.

"When the regulus is weighed, try its malleability: then make it red-hot; and when so, strike it with a hammer: if it bears the strokes of a hammer, both when red hot and when cold, and extends a little, you may pronounce your iron very good; but if, when either

Essaying of Ores of Iron.

either hot or cold, it proves brittle, you may judge it to be not quite pure, but still in a semi-mineral condition.

"*Remarks.* The arsenic, but especially the sulphur must be dissipated by roasting: for the former renders the iron brittle; and the latter not only does the same, but, being managed in a close vessel, with a saline alkaline flux, turns to a liver of sulphur; to the action of which iron yielding in every respect, it can upon no account be precipitated, and if not the whole, a great part of it at least is retained by the sulphureous scoria; so that in this case you commonly in vain look for a regulus.

"The iron obtained from this first precipitation has hardly ever the requisite ductility, but is rather brittle; the reason of which is, that the sulphur and arsenic remains in it; for notwithstanding that the greatest part of these is dissipated by roasting, yet some part adheres so strictly, that it can never be separated but with absorbent, terrestrial, alkaline ingredients, that change the nature of the sulphur. For which reason, in larger operations, they add quicklime, or marble stones that turn into quicklime; which, while they absorb the said minerals, are, by it and by help of the destroyed part of the iron, brought to a fusion, and turn to a vitrified scoria; although, at other times, they resist so much by their own nature a vitrification. Another cause of the brittleness of iron is the unmetallic earth, when it is not yet separated from it; for the iron ore contains a great quantity of it, and in the melting remains joined with the reguline part: whence the iron is rendered very coarse and brittle. Some iron ores are altogether untractable: nevertheless, the reguluses produced out of them, when broken, have sometimes a neat semimetallic look; which proceeds undoubtedly from a mixture of a small quantity of some other metal or semimetal."

PROCESS II.

[The following Process for essaying iron ores, and ferruginous stones and earths, is extracted from Mr Gellert's *Elements of essaying*.]

"Roast two quintals of iron ore, or of ferruginous earth: divide the roasted matter into two equal parts: to each of which add half a quintal of pulverised glass, if the substance be fusible and contain much metal; but if otherwise, add also half a quintal of calcined borax. If the roasting has entirely disengaged the sulphur and arsenic, an eighth part, or even half a quintal, of quicklime may be added. With the above matters mix twelve pounds of charcoal-powder.

"Take a crucible, and cover the bottom and sides of its inner surface with a paste made of three parts of charcoal-dust and one part of clay beat together. In the hollow left in this paste put the above mixture; press it lightly down; cover it with pulverised glass; and put on the lid of the crucible.

"Place two such crucibles at the distance of about four fingers from the air-pipe, in such a manner that the air shall pass betwixt them at about the third part of the height from the bottom; fill the space betwixt the two crucibles with coals of a moderate size: throw lighted coals upon them, that the fire may descend and make them red-hot from top to bottom; at first let the bellows blow softly, and afterwards strongly during an hour, or an hour and a quarter: then take away the crucible, and break it when cold. A regulus will be found in the bottom, and sometimes some small grains of iron in the scoria, which must be separated and weighed along with the regulus: then try the regulus whether it can be extended under the hammer when hot and when cold.

"*Remarks.* To disengage a metal from the earthy matters mixed with it by fire, we must change these matters into scoria or glass. This change may be effected by adding some substance capable of dissolving these matters; that is, of converting them into a scoria or glass, from which the metallic matters may, by their weight, separate and form a regulus at bottom. Fixed alkali, which is an ingredient of the black and of the white flux, is a powerful solvent of earths and stones; but the alkali does also dissolve iron, especially when this is in a calcined or earthy state; and this solution is so much more complete, as the fire is longer applied. Hence, in ordinary essays, where an alkaline salt is used, little or no regulus of iron is obtained. Now, glass acts upon and dissolves earths and stones; but not, or very little, iron: consequently glass is the best flux for such essays, and experience confirms this assertion. If the ore contains but little iron we may also add to the glass some borax; but borax cannot be employed singly, because it very soon fuses and separates from the ore before the metal is revived. Quicklime is added, not only to absorb the sulphur and arsenic remaining in the ore, but also because it dissolves and vitrifies the stony and earthy matters of iron ores which are generally argillaceous. For which reason, in the large operations for smelting iron ore, quicklime, and even in certain cases gypsum, are commonly added to facilitate the fusion.

"The reduction of iron-ore, and even the fusion of iron, requires a violent and long-continued heat: therefore in this operation, we must not employ an inflammable substance, as pitch, that is soon consumed, but charcoal pulverised, which in close vessels is not sensibly wasted. Too much charcoal must not be added, else it will prevent the action of the glass upon the earthy matter of the ore, and consequently the separation of the metallic part. Experiments have taught me, that one part of charcoal dust to eight parts of ore was the best proportion.

"When iron is surrounded by charcoal, it is not decomposed or destroyed; hence the iron of the ore, which sinks into the hollow made of paste of charcoal, dust and clay, remains there unhurt. The clay is added in this paste to render it more compact, and to keep the fluid iron collected together.

"The air is directed betwixt the crucibles; because if it was thrown directly upon them, they would scarcely be able to resist the heat. The space betwixt the air-pipe and the crucibles ought to be constantly filled with charcoal, to prevent the cold air from touching the crucibles. Ductile and malleable iron is seldom obtained in this first operation. The sulphur and arsenic, and frequently also an earthy matter adhering to the iron, prevent these qualities."

Essaying of Ores of Mercury.

Sect. VIII. *Ores of Mercury.*

§ 1. Mercury is sometimes found pure, fluid, and in its proper metallic state, only mixed with earths and stones. Such are the ores of mercury found near Montpelier, in Tuscany, and in other places.

But the largest quantity of the mercury found in the earth is mineralised by sulphur, and consequently is in the form of cinnabar.

Mercury is never mineralised by arsenic. The richest mine of mercury is that of Almaden, in Spain.

Linnæus and Cronstedt mention a singular ore, in which the mercury is *mineralised by sulphur and by copper*. It is said to be of a blackish-grey colour, of a glassy texture, and brittle. When the mercury and sulphur are expelled by fire, the copper is discovered by giving an opake red colour to glass of borax, which, by continuance and increase of heat, becomes green and transparent.

§ 2. Cramer directs, that *ores of mercury should be essayed* by the following processes:

PROCESS I.

To separate mercury out of an unsulphureous ore by distillation.

"Take a lump of the pulverised ore, one common pound, which must stand for one centner: put it into a glass retort perfectly clean, well loricated, or coated up to half the length of its neck: this must be very long, and turned backwards with such a declivity, that a glass recipient may be perpendicularly applied to it: but you must choose a retort small enough, that the belly of it may be filled hardly two-thirds with the ore: this retort must be placed so, that nothing of the fluid adherent to the neck of it may fall in the cavity of the belly, but that the whole may run forward into the recipient. Finally, have a small recipient full of cold water: let it be perpendicularly situated, and receive the neck of the retort in such manner that the extremity of it be hardly one half-inch immersed into the water.

"Let the retort be surrounded with hot burning coals placed at some distance in form of a circle, lest the vessel should burst by too sudden a heat: then by degrees bring the burning coals nearer and nearer, and at last surround the whole retort with them and with fresh charcoal, that it may grow slightly red-hot; this fire having been continued for an hour, let the retort cool of itself: then strike the neck of it gently, that the large drops which are always adherent to it may fall into the recipient: let the recipient be taken away and the water separated from the mercury by filtration, and let the mercury be weighed. This operation may be more conveniently performed in a sand-bath; in which case the pot containing the sand must be middling red-hot, and the retort be able to touch the bottom of it immediately; nor is it then necessary that the retort be loricated."

PROCESS II.

To revive mercury from a sulphureous cinnabar-ore.

"Beat your ore extremely fine, and mix it exactly with an equal portion of iron-fillings, not rusty; proceed to distil it with the same apparatus as in the former process, but urge it with the strongest fire that can be made.

"Cinnabar may be separated from stones by sublimation thus: Beat it to a fine powder, and put it into a small narrow glass or earthen cucurbit, the belly of which it must not fill more than one-third part: stop the orifice at top; this must be very narrow, to hinder the free action of the air. Put this small cucurbit in an earthen pot above two inches wide in diameter, and gather sand around this pot about as high as the pulverised ore rises in the cucurbit. Then put it upon burning coals in such manner that the bottom of the pot may be middling red-hot. Thus will your cinnabar ascend and form a solid ponderous ring, which must be got out by breaking the vessel."

Ores of Antimony.

Sect. IX. *Ore of the Regulus of Antimony.*

Native regulus of antimony was first observed by Mr Swab, in Sweden, in the mine of Salberg, and described by him in the memoirs of the Swedish Academy in 1749. Mr Wallerius mentions it in his Mineralogy.

Regulus, of antimony is generally united with sulphur, with which it forms antimony, which ought to be considered as a true ore of the regulus of antimony.

Another ore of regulus of antimony is also known of a red colour, in which the regulus is mineralised both by arsenic and by sulphur. This ore resembles some iron ores, and some kind of blend. It is distinguished by its great fusibility, which is such, that it may be easily melted by the flame of a candle.

The *native regulus* of antimony, by Von Swab, is said by that author to have differed from the regulus of antimony obtained from ores, in these two properties, that it was capable of being easily amalgamated with mercury, and that its calx shot into crystals during the cooling.

Besides the ores of regulus of antimony enumerated above, this semimetal is also found in ores of other metallic substances, as in the *plumose silver-ore*, and in the *stibiated lead-ore*.

§ 2. The *ores of antimony may be essayed* by the following processes described by Mr Cramer.

PROCESS I.

To obtain antimony from its ore.

"Choose a melting crucible, or an earthen pot not glazed, that may contain some common pounds of the ore of antimony, broken into small bits. Bore at the bottom of the crucible some small holes, two lines in diameter. Let the bottom of the vessel be received by the orifice of a smaller one, upon which it must be put; and when the ore is put into it, let it be covered with a tile, and all the joints be stopped with lute.

"Put these vessels upon the pavement of a hearth and put stones all around them at the distance of six inches. Fill this intermediate space with ashes, so high that the inferior pot be covered to the upper brim. Then put fresh and burning coals upon it, and with a pair of hand-bellows excite the fire, till the

Essaying of Ores of Antimony.

the upper vessels grow red-hot: take off the fire a quarter of an hour after; and when the vessels are grown cold, open them. You will find that the melted antimony has run through the holes made at the bottom of the upper vessel into the inferior one, where it is collected."

PROCESS II.

To roast crude antimony, or its ore, with or without addition.

"Choose an earthen, flat, low dish, not glazed; and if it cannot bear being made middling red-hot; cover it over with a coat of lute without. Spread it thinly over with crude antimony, or with its ore, beaten to a pretty coarse powder, not exceeding a few ounces at once. Put the dish upon a fire-pan, having a few burning coals in it: increase the fire till it begins to smoke a little. Meanwhile you must incessantly move the powder with a piece of new tobacco-pipe; for this causes the sulphur to evaporate the sooner. If you increase the fire a little too soon, the powder immediately gathers into large clots, or even begins to melt. When this happens, take it immediately off the fire before it melts entirely. Then pulverise it again, and finally make a gentle fire under it. Your black shining powder will assume an ash colour almost like that of earth, and become more refractory in the fire; wherefore you may then increase the fire till your powder grows middling red-hot, and let it last till it ceases to smoke. If you add to your crude antimony pulverised, half or an equal quantity of charcoal-dust, and perform the rest as above, the roasting will be done more conveniently: for it does not gather so easily into clots, and melts with much greater difficulty. When part of the sulphur is evaporated, add some fat to it at several times. Thus you will sooner finish the operation, and the remaining calx will not be burnt to excess. However, if it be thus exposed to too violent and long-lasting a fire, a great quantity of it evaporates; nor does it cease entirely to smoke in a great fire. And it will be enough, if, growing middling red-hot, it does no longer emit the unpleasant smell of the acid of sulphur."

PROCESS III.

To reduce a calx of antimony into a semimetallic regulus.

"Mix some calx of antimony with a quarter part of the black flux, and put into the crucible. Cover the vessel with a tile; make the fire as quickly as the vessel can bear it, but no greater than is necessary to melt the flux. When the whole has been well in fusion for half a quarter of an hour (which may be tried with a tobacco-pipe, taking off the tile), pour it into the melting cone, which must be warm and done over with tallow. Then immediately strike the cone several times. You will find, when the cone is inverted, a regulus, above which is a saline scoria."

The methods of *calcining antimony by means of nitre*, are described under Chemistry, n° 1252—1265; and those of obtaining a *regulus of antimony* without a previous calcination or roasting, by throwing a mixture of powdered antimony, tartar, and nitre, into a red-hot crucible, and by fusing this mixture, and of obtaining a *martial regulus of antimony*, are described at the article Regulus.

Ores of Bismuth.

SECT. X. *Ores of Bismuth.*

§ 1. Bismuth is found *native*, resembling the regulus of bismuth.

An *ochre* of bismuth, of a whitish yellow colour, is mentioned by Cronstedt; and is different from the ore improperly called *flowers of bismuth*, which is a calx of cobalt.

Bismuth is mineralised. 1. By *sulphur*. This ore has the appearance of galena. 2. With *sulphurated iron*. Bismuth is found also in cobalts, and in some ores of silver.

§ 2. *Ores of bismuth* may be *essayed* by the following process.

"Bismuth ore may be melted with the same apparatus as was directed for the fusion of crude antimony out of its ore. Or you may beat your ore to a very fine powder, with the black flux, sandiver, and common salt, in a close vessel, like the ore of lead or of tin, and melt it in a middling fire, having a draught of air. But as this semimetal is destructible and volatile, you must as quick as possible apply it to that degree of fire, which the flux requires to be melted; and so soon as it is well melted, the vessel must be taken out of the fire; and when it is grown quite cold and broken, you will find your regulus."

Mr Gellert directs that ores of bismuth should be essayed by fusing a quintal of pulverised ore with half a quintal of calcined borax and half a quintal of pulverised glass, in order to vitrify the adherent earths and stones which envelope the bismuth. But probably the heat requisite for this vitrification would volatilise part of the bismuth.

If the ore be of the kinds above described, mineralised by sulphur, or by sulphur and iron, a previous roasting would be expedient, which may be performed in the same manner as is directed for the roasting of antimony.

SECT. XI. *Ores of the Regulus of Cobalt.*

Cobalt is a grey-coloured mineral, with more or less of a metallic appearance. Its grain is close; it is compact and heavy, and frequently covered with an efflorescence of peach-coloured flowers. Of this several kinds are known †. All the true cobalts contain the semimetal called *regulus* of cobalt, the calx of which becomes blue by vitrification. This regulus is mineralised in cobalt by sulphur, and especially by a large quantity of arsenic. Some cobalts also contain bismuth and silver.

† See Cobalt.

Authors have given the name of *cobalt* to many minerals, although they do not contain the semimetal abovementioned, but only because they externally resemble the ore of the regulus of cobalt. But these minerals can only be considered as false cobalts. They are distinguishable from true cobalt by trying whether they can yield the blue glass called *smalt*, and the sympathetic ink. The red efflorescence is also a mark by which true cobalt is distinguishable from the false-

Ores of Cobalt.

falſe: but this efflorescence only happens when the ore has been expoſed to a moiſt air.

The principal mines of cobalt are in Saxony, where they are dug for the ſake of obtaining zaffre, azure-blue or ſmalt, and arſenic. Very fine cobalt is alſo found in the Pyrenean mountains. It has been likewiſe found in Cornwall and Scotland. And that it is in the eaſtern parts of Aſia, appears from the blue colouring on old oriental porcelain: but probably the mines diſcovered in theſe countries are nearly exhauſted, as conſiderable quantities of zaffre and ſmalt are exported from Europe to China.

Cobalt is heavier than moſt other ores, from the large quantity of arſenic it contains; and in this reſpect it reſembles the ore of tin.

Beſides the grey or aſh-coloured cobalt above deſcribed, which is the moſt frequent, other cobalts are found of various colours and textures, mixed with various ſubſtances. Wallerius enumerates ſix ſpecies of cobalts. 1. The *aſh-coloured ore*, which is regulus of cobalt mineraliſed by arſenic, conſiſting of ſhining leaden-coloured grains. Some ores of this kind are compact reſembling ſteel, and others are of a looſe texture and friable. 2. The *ſpecular ore* is black, ſhining like a mirror, and laminated. This ſpecies is very rare; and is ſuppoſed by Wallerius to be a foliated ſpar, or ſelenites mixed with cobalt. 3. The *vitreous* or *ſlag-like ore*, is of a bluiſh, ſhining colour, compact, or ſpongy. 4. *Cryſtallized ore*, is a grey, deep-coloured cobalt, conſiſting of cluſters of cubical, pyramidal, priſmatic cryſtals. 5. *Flowers of cobalt*, red, yellow, or violet. Theſe flowers ſeem to be formed from ſome of the above-deſcribed compact ores, decompoſed by expoſure to moiſt air. This decompoſition is ſimilar to that which happens to ferruginous and cupreous pyrites. 6. The *earthy cobalt* is of a greeniſh white, or of a yellow colour, and of a ſoft and friable texture. This ſpecies ſeems to be an ochre of cobalt; and is formed perhaps from the flowers of cobalt further decompoſed, in the ſame manner as a martial ochre is formed from the ſaline efflorescence of decompoſing pyrites; when this efflorescence is further decompoſed by expoſure to moiſt air; by which the vitriolic acid contained in it is expelled, and the efflorescence is changed from a ſaline ſtate to that of an ochre or calx.

Beſides theſe proper ores, cobalt is alſo found in a blue clay along with native ſilver, in ores of biſmuth, and in the mineral called *kupfernickel*. See NICKEL.

The *eſſay* of cobalt is deſcribed at the article REGULUS *of Cobalt*.

SECT. XII. *Ores of Zinc.*

§ 1. THE proper ore of zinc is a ſubſtance which has rather an earthy or ſtony than metallic appearance, and is called *calamy*, *calamine*, or *lapis calaminaris*. This ſtone, although metallic, is but moderately heavy, and has not the brilliancy of moſt other ores. Its colour is yellow, and like that of ruſt. It is alſo leſs denſe than other metallic minerals. It ſeems to be an ore naturally decompoſed. The calamine is not worked directly to obtain zinc from it, becauſe this would only ſucceed in cloſe veſſels, and conſequently with ſmall quantities, according to Mr Margraaf's proceſs. But it is ſucceſsfully employed for the converſion of copper into braſs by cementation, by which the exiſtence of zinc in that ſtone is ſufficiently proved.

Ores of Zinc.

Mr Wallerius enumerates alſo amongſt the ores of zinc a very compounded mineral, conſiſting of zinc, ſulphur, iron, and arſenic. This mineral, called *blend*, reſembles externally the ore of lead, and hence has been called *falſe galena*. Theſe blends have different forms and colours; but are chiefly red, like the red ore of antimony.

Zinc is obtained from certain minerals in the Eaſt Indies, of which we know little.

Calciform ores of zinc, according to Cronſtedt, are pure or mixed. The pure are indurated, and ſometimes cryſtallized, reſembling lead-ſpar. The mixed ore contains alſo ſome calx of iron. This is *calamine*. It is whitiſh, yellowiſh, reddiſh, or brown.

Zinc is *mineraliſed*, 1. By *ſulphurated iron*. *Ore of zinc*. Wallerius ſays, lead is ſometimes contained in this ore. It is white, blue, or brown. 2. By *ſulphur, arſenic, and iron*. *Blend*, or *pſeudo-galena*, or *falſe-galena*, or *black-jack*. Theſe are of various colours, white, yellowiſh, brown, reddiſh, greeniſh, black. They conſiſt of ſcales, or are teſſelated. Mr Cronſtedt thinks, that in the blends the zinc is mineraliſed in the ſtate of a calx, and in the ore of zinc in its metallic ſtate.

§ 2. Although the minerals above enumerated have been known, from their property of converting copper into braſs, to be ores of zinc, yet the method of eſſaying them ſo as to obtain the contained zinc was not known, or at leaſt not publiſhed, before Mr Margraaf's Memoir of the Berlin Academy for the year 1746, upon that ſubject. That very able chemiſt has ſhown, that zinc may be obtained from its ores, from the flowers, or from any other calx of zinc, by treating theſe with charcoal-duſt, in cloſe veſſels, to prevent the combuſtion of the zinc, which happens immediately upon its reduction when expoſed to air. For this purpoſe, he put a quantity of finely powdered calamine, or roaſted blend, or other calx of zinc, well mixed with an eighth part of charcoal-duſt, into a ſtrong, luted earthen retort, to which he fitted a receiver. Having placed his retort in a furnace and raiſed the fire, he applied a violent heat during two hours. When the veſſels were cold and broken, he found the zinc in its metallic form adhering to the neck of the retort.

The chief difficulty in this operation is to get an earthen retort ſufficiently compact to retain the vapour of the zinc (for it eaſily pervades the Heſſian crucibles. Stourbridge melting pots, and ſimilar veſſels, as may be ſeen from the quantity of flowers which appear upon their outer ſurface, when zinc or its calxes and any inflammable matter have been expoſed to heat within theſe veſſels), and at the ſame time ſufficiently ſtrong to reſiſt the violent fire which Mr Margraaf requires.

A pretty exact eſſay of an ore of zinc may be made in the followiug manner.

Mix a quantity of pulveriſed roaſted ore or calx of zinc with

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with an eighth part of charcoal-duſt. Put this mixture into a crucible capable of containing thrice the quantity. Diffuſe equally amongſt this mixture a quantity of ſmall grains or thin plates of copper equal to that of the calamine or ore employed, and upon the whole lay another equal quantity of grains or plates of copper; and laſtly, cover this latter portion of copper with charcoal-duſt. Lute a lid upon the crucible, and apply a red heat during an hour or two. The copper or part of it will unite with the vapour of the zinc, and be thereby converted into braſs. By comparing the weight of all the metal after the operation with the weight of the copper employed, the weight acquired, and conſequently the quantity of zinc united with the copper will be known. The copper which has not been converted into braſs, or more copper with freſh charcoal-duſt, may be again added in the ſame manner to the remaining ore, and the operation repeated with a heat ſomewhat more intenſe, that any zinc remaining in the ore may be thus extracted. A curious circumſtance is, that a much greater heat is required to obtain zinc from its ore by diſtillation, than in the operation now deſcribed of making braſs; in which the ſeparation of the zinc from its ore ſeems to be facilitated by its diſpoſition to unite with copper.

Sect. XIII. *Ores of Arſenic.*

§ 1. The minerals which contain the largeſt quantity of arſenic are cobalts and white pyrites; although it is alſo contained in other ores, it being one of the mineraliſing ſubſtances. But as cobalt muſt be roaſted to obtain the ſulphur it contains, the arſenic alſo which riſes during this torrefaction is collected, as we ſhall ſee in part III. (Smelting of Ores), and the particular articles of each of the metallic ſubſtances mentioned in this article.

I. Regulus of arſenic is found native. It is of a leaden colour; it burns with a ſmall flame; and is diſſipated, leaving generally a very ſmall quantity of calx of biſmuth, or of calx of cobalt, and a very little ſilver. When it is of a ſolid and teſtaceous texture, it has been improperly called *teſtaceous cobalt*, in German *ſcherbencobalt*. II. Calx of arſenic is found in form of powder; native flowers of arſenic, or of indurated ſemitranſparent cryſtals; native cryſtalline arſenic. III. Calx of arſenic is mixed, 1. With ſulphur; when yellow, it is called *orpiment*; when red, it is called *native realgar*: the difference of colour depends on the proportion of the two component parts. 2. With calx of tin; tin-grains. 3. With ſulphur and ſilver, in the red ſilver ore. 4. With calx of lead, in the lead-ſpar. 5. With calx of cobalt, in the efflorescence of cobalt. IV. Arſenic is mineraliſed, 1. With ſulphurated iron; arſenical pyrites. 2. With iron only; white pyrites, or miſpickle. 3. With cobalt, in almoſt all cobalt-ores. 4. With ſilver. 5. With copper. 6. With antimony.

§ 2. Arſenic may be ſeparated from its ore or earthy matter with which it happens to be mixed, by ſublimation, according to the following proceſs by Mr Cramer.

"Do every thing as was ſaid about mercury, or ſulphur; but let the veſſel which is put into the fire with the ore in it be of earth or ſtone, and the recipient be of glaſs, and of a middling capacity. Nor is it neceſſary that this ſhould be filled with water, ſo it be but well luted. The fire muſt likewiſe be ſtronger and continued longer than for the extracting of ſulphur. Nevertheleſs, every kind of arſenic cannot be extracted in a confined fire: for it adheres to the matrix more ſtrongly than ſulphur and mercury. You will find in the part of the veſſel which is more remote from the fire pulverulent and ſubtile flowers of arſenic; but there will adhere to the poſterior of the neck of the retort ſmall ſolid maſſes, ſhining like ſmall cryſtals, tranſparent, ſometimes gathered into a ſolid ſublimate, and perfectly white, if the ore of the arſenic was perfectly pure; which nevertheleſs happens very ſeldom. The flowers are moſt commonly thin, and of a grey colour: which proceeds from the phlogiſton mixed with the maſs. They are often of a citron or of a golden colour, which is a ſign that there is in the mixture ſome mineral ſulphur; and if the ſublimate be red or yellow, it is a ſign of much ſulphur.

"As all the arſenic contained in the ore is not expelled in cloſe veſſels, you muſt weigh the reſiduum; then roaſt it in a crucible till it ſmokes no longer, or rather in an earthen flat veſſel not glazed, and in a ſtrong fire to be ſtirred now and then with a poker, and then weigh it when grown cold: you will be able thus to know how much arſenic remained in the cloſe veſſel, unleſs the ore contain biſmuth."

If the arſenic be ſulphurated, it may be purified by triturating it with mercury or with fixed alkali, and by ſubliming the arſenic from the remaining ſulphurated mercury or alkali. The method of obtaining a regulus of arſenic is deſcribed at the article *Regulus of Arſenic*.

PART III.

SMELTING of ORES.

Having ſhown the nature of the principal metallic minerals, and the ſubſtances of which they are compoſed; and alſo explained the proceſſes by which an exact analyſis of theſe compound minerals may be made, and the nature and quantity of the contained metals may be known; in order to complete what relates to this important ſubject, we ſhall deſcribe in this Part the principal operations by which metals, &c. are obtained "in the great," as it is called, or for commercial purpoſes. What we ſhall ſay upon this ſubject will chiefly be extracted from a *Treatiſe on the Smelting of Ores, by Schlatter*, tranſlated from the German into French by M. Hellot; becauſe this, of all the modern works upon that ſubject, appears to be the moſt exact. We ſhall firſt deſcribe the operations upon pyritous matters for the extraction of ſulphur

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phur, &c. and afterwards the operations by which metallic substances are extracted from *ores* properly so called.

SECT. I. *Extraction of sulphur from Pyrites and other Minerals.*

IN order to obtain sulphur from pyrites, this mineral ought to be exposed to a heat sufficient to sublime the sulphur or to make it distil in vessels, which must be close, to prevent its burning.

Sulphur is extracted from pyrites at a work at Schwartzember, in Saxony, in the high country of the mines; and in Bohemia at a place called *Alten-Sattel.*

The furnaces employed for this operation are oblong, like vaulted galleries; and in the vaulted roofs are made several openings. These are called *furnaces for extracting sulphur.*

In these furnaces are placed earthen-ware tubes, filled with pyrites broken into pieces of the size of small nuts. Each of these tubes contains about 50 pounds of pyrites. They are placed in the furnace almost horizontally, and have scarcely more than an inch of descent. The ends, which come out of the furnace five or six inches, become gradually narrower. Within each tube is fixed a piece of baked earth, in form of a star, at the place where it begins to become narrower, in order to prevent the pyrites from falling out, or choaking the mouth of the tube. To each tube is fitted a receiver covered with a leaden pipe, pierced with a small hole to give air to the sulphur. The other end of the tube is exactly closed. A moderate fire is made with wood, and in eight hours the sulphur of the pyrites is found to have passed into the receivers.

The residuum of the pyrites, after the distillation, is drawn out at the large end, and fresh pyrites is put in its place. From this residuum, which is called *burnings of sulphur*, vitriol is extracted.

The 11 tubes into which were put, at three several distillations, in all nine quintals, or 900 pounds of pyrites, yield from 100 to 150 pounds of crude sulphur, which is so impure as to require to be purified by a second distillation.

This purification of crude sulphur is also done in a furnace in form of a gallery, in which five iron cucurbits are arranged on each side. These cucurbits are placed in a sloping direction, and contain about eight quintals and a half of crude sulphur. To them are luted earthen tubes, so disposed as to answer the purpose of capitals. The nose of each of these tubes is inserted into an earthen pot called the *fore runner.*

This pot has three openings; namely that which receives the nose of the tube; a second smaller hole, which is left open to give air; and a third in its lower part, which is stopped with a wooden peg.

When the preparations are made, a fire is lighted about seven o'clock in the evening, and is a little abated as soon as the sulphur begins to distil. At three o'clock in the morning, the wooden pegs which stop the lower holes of the fore-runners are for the first time drawn out, and the sulphur flows out of each of them into an earthen pot with two handles, placed below for its reception. In this distillation the fire must be moderately and prudently conducted; otherwise less sulphur would be obtained, and it also would be of a grey colour and not of the fine yellow which it ought to have when pure. The ordinary loss in the purification of eight quintals of crude sulphur is at most, one quintal.

When all the sulphur has flowed out, and has cooled a little in the earthen-pots, it is cast into moulds made of beech tree, which have been previously dipt in water and set to drain. As soon as the sulphur is cooled in the moulds, they are opened, and the cylinders of sulphur are taken out and put up in casks. These are called *roll brimstone.*

As sulphur is not only in pyrites, but also in most metallic minerals, it is evident that it might be obtained by works in the great from the different ores which contain much of it, and from which it must be separated previously to their fusion: but as sulphur is of little value, the trouble of collecting it from ores is seldom taken. Smelters are generally satisfied with freeing their ores from it, by exposing them to a fire sufficient to expel it. This operation is called *torrefaction*, or *roasting of ores.*

There are, however, ores which contain so much sulphur, that part of it is actually collected in the ordinary operation of roasting, without much trouble for that purpose. Such is the ore of Ramelsberg in the country of Hartz.

This ore, which is of lead, containing silver, is partly very pure, and partly mixed with cupreous pyrites and silver; hence it is necessary to roast it.

The roasting is performed by laying alternate strata of ore and wood upon each other in an open field, taking care to diminish the size of the strata as they rise higher; so that the whole mass shall be a quadrangular pyramid truncated above, whose base is about 31 feet square. Below, some passages are left open, to give free entrance to the air; and the sides and top of the pyramid are covered over with small ore, to concentrate the heat and make it last longer. In the centre of this pyramid there is a channel which descends vertically from the top to the base. When all is properly arranged, ladlefuls of red-hot scoria from the smelting furnace are thrown down the channel, by which means the shrubs and wood placed below for that purpose are kindled, and the fire is from them communicated to all the wood of the pile, which continues burning till the third day. At that time the sulphur of the mineral becomes capable of burning spontaneously, and of continuing the fire after the wood is consumed.

When this roasting has been continued 15 days, the mineral becomes greasy; that is, it is covered over with a kind of varnish: 20 or 25 holes or hollows are then made in the upper-part of the pile in which the sulphur is collected. From these cavities the sulphur is taken out thrice every day, and thrown into water. This sulphur is not pure, but crude; and is therefore sent to the manufacturers of sulphur, to be purified in the manner above related.

As this ore of Ramelsberg is very sulphureous, the first roasting, which we are now describing, lasts three months; and during this time, if much rain has not fallen, or if the operation has not failed by the pile falling

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falling down or cracking, by which the air has so much free access, that the sulphur is burnt and consumed, from 10 to 20 quintals of crude sulphur are by this method collected.

The sulphur of this ore, like that of most others, was formerly neglected, till, in the year 1570, a person employed in the mines called *Christopher Sauder*, discovered the method of collecting it, nearly as it is done at present.

Metallic minerals are not the only substances from which sulphur is extracted. This matter is diffused in the earth in such quantities, that the metals cannot absorb it all. Some sulphur is found quite pure, and in different forms, principally in the neighbourhood of volcanoes, in caverns, and in mineral waters. Such are the opaque kind called *virgin-sulphur*; the transparent kind called *sulphur of Quito*; and the native flowers of sulphur, as those of the waters of Aix-la-Chapelle. It is also found mixed with different earths. Here we may observe, that all those kinds of sulphur which are not mineralised by metallic substances, are found near volcanoes, or hot mineral waters, and consequently in places where nature seems to have formed great subterranean laboratories; in which sulphureous minerals may be analysed and decomposed, and the sulphur separated, in the manner in which it is done in small in our works and laboratories. However that be, certainly one of the best and most famous sulphur-mines in the world is that called *Solfatara*. The Abbé Nollet has published, in the Memoirs of the academy, some interesting observations upon this subject, which we shall here abridge.

Near Puzzoli, in Italy, is that great and famous mine of sulphur and alum called at present *Solfatara*. It is a small oval plain, the greatest diameter of which is about 400 yards, raised about 300 yards above the level of the sea. It is surrounded by high hills and great rocks, which fall to peices, and whose fragments form very steep banks. Almost all the ground is bare and white, like marle; and is every where sensibly warmer than the atmosphere in the greatest heat of summer, so that the feet of persons walking there are burnt through their shoes. It is impossible not to observe the sulphur there; for every-where may be perceived by the smell a sulphureous vapour, which rises to a considerable height, and gives reason to believe that there is a subterraneous fire below, from which that vapour proceeds.

Near the middle of this field there is a kind of bason three or four feet lower than the rest of the plain, in which a sound may be perceived when a person walks on it, as if there were under his feet some great cavity, the roof of which was very thin. After that the lake Agnano is perceived, whose waters seem to boil. These waters are indeed hot, but not so hot as boiling water. This kind of ebullition proceeds from vapours which rise from the bottom of the lake, which being set in motion by the action of subterranean fires, have force enough to raise all that mass of water. Near this lake there are pits, not very deep, from which sulphureous vapours are exhaled. Persons who have the itch come to these pits, and receive the vapours in order to be cured. Finally, there are some deeper excavations, whence a soft stone is procured which yields sulphur. From these cavities vapours exhale, and issue out with noise, and which are nothing else than sulphur subliming through the crevices. This sulphur adheres to the sides of the rocks, where it forms enormous masses: in calm weather, the vapours may be evidently seen to rise 25 or 30 feet from the surface of the earth.

These vapours, attaching themselves to the sides of rocks, form enormous groups of sulphur, which sometimes fall down by their own weight, and render these places of dangerous access.

In entering the Solfatara, there are warehouses and buildings erected for the refining of sulphur.

Under a great shed, or hangar, supported by a wall behind, and open on the other three sides, the sulphur is procured by distillation from the soft stones we mentioned above. These stones are dug from under ground; and those which lie on the surface of the earth are neglected. These last are, however, covered with a sulphur ready formed, and of a yellow colour: but the workmen say they have lost their strength, and that the sulphur obtained from them is not of so good a quality as the sulphur obtained from the stones which are dug out of the ground.

These last mentioned are broken into lumps, and put into pots of earthen ware, containing each about 20 pints Paris measure. The mouths of these pots are as wide as their bottoms; but their bellies, or middle parts, are wider. They are covered with a lid of the same earth, well luted, and are arranged in two parallel lines along two brick walls, which form the two sides of a furnace. The pots are placed within these walls; so that the centre of each pot is in the centre of the thickness of the wall, and that one end of the pots overhangs the wall within, while the other end overhangs the wall without. In each furnace ten of these pots are placed; that is, five in each of the two walls which form the two sides of the furnace." Betwixt these walls there is a space of 15 or 18 inches; which space is covered by a vault resting on the two walls. The whole forms a furnace seven feet long, two feet and a half high, open at one end, and shut at the other, excepting a small chimney through which the smoke passes.

Each of these pots has a mouth in its upper part without the furnace, in order to admit a tube of 18 lines in diameter and a foot in length, which communicates with another pot of the same size placed without the building, and pierced with a round hole in its base of 15 or 18 lines diameter. Lastly, to each of these last-mentioned pots there is a wooden tub placed below, in a bench made for that purpose.

Four or five of these furnaces are built under one hangar, or shed. Fires are kindled in each of them at the same time; and they are thrown down after each distillation, either that the pots may be renewed, or that the residuums may be more easily taken out.

The fire being kindled in the furnace, heats the first pots containing the sulphureous stones. The sulphur rises in fumes into the upper part of the pot, whence it passes through the pipe of communication into the external vessel. There the vapours are condensed, become liquid and flow through the hole below into the tub, from which the sulphur is easily turned out, because the form of the vessel is that of a truncated cone

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whose narrower end is placed below, and because the hoops of the tub are so fastened that they may be occasionally loosened. The mass of sulphur is then carried to the buildings mentioned before, where it is remelted for its purification, and cast into rolls, such as we receive it.

Extraction of VITRIOL *from pyrites.* See CHEMISTRY.

Extraction of ALUM *from pyritous substances and from aluminous earths.* See CHEMISTRY.

SECT. II. *Smelting of Ores in general.*

§ 1. As ores consist of metallic matters combined with sulphur and arsenic, and are besides intermixed with earthy and stony substances of all kinds, the intention of all the operations upon these compound bodies is to separate these different substances from each other. This is effected by several operations founded on the known properties of those substances. We now proceed to give a general idea of these several operations.

First of all, the ore is to be separated from the earths and stones accidentally adherent to it; and when these foreign substances are in large masses, and are not very intimately mixed in small particles with the ore, this separation may be accomplished by mechanical means. This ought always to be the first operation, unless the adherent substance be capable of serving as a flux to the ore. If the unmetallic earths be intimately mixed with the ore, this must necessarily be broken and divided into small particles. This operation is performed by a machine which moves pestles, called *bocords* or *stampers*. After this operation, when the parts of the mineral are specifically heavier than those of the unmetallic earth or stone, these latter may be separated from the ore by washing in canals through which water flows. With regard to this washing of ores, it is necessary to observe, that it cannot succeed but when the ore is sensibly heavier than the foreign matters. But the contrary happens frequently, as well because quartz and spar are naturally very ponderous, as because the metallic matter is proportionally so much lighter as it is combined with more sulphur.

When an ore happens to be of this kind, it is necessary to begin by roasting it, in order to deprive it of the greatest part of its sulphur.

It happens frequently that the pyritous matters accompanying the ore are so hard that they can scarcely be pounded. In this case it is necessary to roast it entirely, or partly, and to throw it red hot into cold water; by which the stones are split, and rendered much more capable of being pulverised.

Thus it happens very frequently, that roasting is the first operation to which an ore is exposed.

When the substance of the ore is very fusible, this first operation may be dispensed with, and the matter may be immediately fused without any previous roasting, or at least with a very slight one. For, to effect this fusion, it is necessary that it retain a great quantity of its sulphur, which, with the other fluxes added, serves to destroy or convert into scoria a considerable part of the stony matter of the mineral, and to reduce the rest into a brittle substance, which is called the *matt of lead* or *of copper*, or other metal contained in the ore. This matt is therefore an intermediate matter betwixt the mineral and the metal; for the metal is there concentrated, and mixed with less useless matter than it was in the ore. But as this matt is always sulphureous, the metal which it contains cannot have its metallic properties. Therefore it must be roasted several times to evaporate the sulphur, before it is remelted, when the pure metal is required. This fusion of an ore not roasted, or but slightly roasted, is called *crude fusion*.

We may here observe upon the subject of washing and roasting of ores, that as arsenic is heavier than sulphur, and has nearly the weight of metals, the ores in which it prevails are generally very heavy, and consequently are susceptible of being washed, which is a great advantage. But on the other side, as arsenic is capable of volitising, scorifying, and destroying many metals, these ores have disadvantages in the roasting and fusion, in both which considerable loss is caused by the arsenic. Some ores contain, besides arsenic, other volatile semimetals, such as antimony and zinc. These are almost untractable, and are therefore neglected. They are called *mineræ rapaces*, "rapacious ores."

When the metal has been freed as much as is possible from foreign matters by these preliminary operations, it is to be completely purified by fusions more or less frequently repeated; in which proper additions are made, either to absorb the rest of the sulphur and arsenic, or to complete the vitrification or scorification of the unmetallic stones and earth.

Lastly, as ores frequently contain several different metals, these are to be separated from each other by processes suited to the properties of these metals, of which we shall speak more particularly as we proceed in our examination of the ores of each metal.

§ 2. To facilitate the extraction of metallic substances from the ores and minerals containing them, some operations previous to the fusion or smelting of these ores and minerals are generally necessary. These operations consist of, 1. The *separation* of the ores and metallic matters from the adhering unmetallic earths and stones, by hammers and other mechanical instruments, and by washing with water. 2, There *division* or reduction into smaller parts by contusion and trituration, that by another washing with water they may be more perfectly cleansed from extraneous matters, and rendered fitter for the subsequent operations, calcination or roasting, and fusion. 3. *Roasting* or *calcination*; the uses of which operation, are, to expel the volatile useless, or noxious substances, as water, vitriolic acid, sulphur, and arsenic; to render the ore more friable, and fitter for the subsequent contusion and fusion; and, lastly, to calcine and destroy the viler metals, for instance the iron of copper-ores, by means of the fire, and of the sulphur and arsenic. Stones, as quartz, and flints, containing metallic veins or particles are frequently made red-hot, and then extinguished in cold water, that they may be rendered sufficiently friable and pulverable, to allow the separation of the metallic particles.

Roasting is unnecessary for native metals; for some of the richer gold and silver ores; for some lead-ores the

Roasting of Ores.

the sulphur of which may be separated during the fusion; and for many calciform ores, as these do not generally contain any sulphur and arsenic.

In the roasting of ores, the following attentions must be given, 1. To reduce the mineral previously into small lumps, that the surface may be increased; but they must not be so small, nor placed so compactly, as to prevent the passage of the air and flame. 2. The larger pieces must be placed at the bottom of the pile, where the greatest heat is. 3. The heat must be gradually applied, that the sulphur may not be melted, which would greatly retard its expulsion; and that the spars, fluors, and stones, intermixed with the ore, may not crack, fly, and be dispersed. 4. The ores not thoroughly roasted by one operation must be exposed to a second. 5. The fire may be increased towards the end, that the noxious matters more strongly adhering may be expelled. 6. Fuel which yields much flame, as wood and fossil coals free from sulphur, is said to be preferable to charcoal or coaks. Sometimes cold water is thrown on the calcined ore at the end of the operation, while the ore is yet hot, to render it more friable.

No general rule can be given concerning the duration or degree of the fire, these being very various according to the difference of the ores. A roasting during a few hours or days is sufficient for many ores; while some, such as the ore of Ramelsberg, require that it should be continued during several months.

Schlutter enumerates five methods of roasting ores. 1. By constructing a pile of ores and fuel placed in alternate strata, in the open air, without any furnace. 2. By confining such a pile within walls, but without a roof. 3. By placing the pile under a roof, without lateral walls. 4. By placing the pile in a furnace consisting of walls and a roof. 5. By roasting the ore in a reverberatory furnace, in which it must be continually stirred with an iron rod.

Several kinds of fusions of ores may be distinguished. 1. When a sulphureous ore is mixed with much earthy matter, from which it cannot be easily separated by mechanical operations, it is frequently melted, in order to disengage it from these earthy matters, and to concentrate its metallic contents. By this fusion, some of the sulphur is dissipated, and the ore is reduced to a state intermediate betwixt that of ore and of metal. It is then called a *matt (lapis sulphureo-metallicus)*; and is to be afterwards treated like a pure ore by the second kind of fusion, which is properly the smelting, or extraction of the metal by fusion. 2. By this fusion or smelting, the metal is extracted from the ore previously prepared by the above operations, if these be necessary. The ores of some very fusible metals, as of bismuth, may be smelted by applying a heat sufficient only to melt the metals, which are thereby separated from the adhering extraneous matters. This separation of metals by fusion, without the vitrification of extraneous matters, may be called *eliquation*. Generally, a complete fusion of the ore and vitrification of the earthy matters are necessary for the perfect separation of the contained metals. By this method, metals are obtained from their ores, sometimes pure, and sometimes mixed with other metallic substances, from which they must be afterwards separated; as we shall see when we treat of the extraction of particular metals. To procure this separation of metals from ores, these must be so thinly liquefied, that the small metallic particles may disengage themselves from the scoria; but it must not be so thin as to allow the metal to precipitate before it be perfectly disengaged from any adhering extraneous matter, or to pervade and destroy the containing vessels and furnace. Some ores are sufficiently fusible; but others require certain additions called *fluxes*, to promote their fusion and the vitrification of their unmetallic parts; and also to render the scoria sufficiently thin to allow the separation of the metallic particles.

Fusion of Ores.

Different fluxes are suitable to different ores, according to the quality of the ore, and of the matrix, or stone adherent to it.

The matrixes of two different ores of the same metal frequently serve as fluxes to each other; as, for instance, an argillaceous matrix with one that is calcareous; these two earths being disposed to vitrification when mixed, though each of them is singly unfusible. For this reason, two or more different ores to be smelted are frequently mixed together.

The ores also of different metals require different fluxes. Thus calcareous earth is found to be best suited to iron-ores, and spars and scoria to fusible ores of copper.

The fluxes most frequently employed in the smelting of ores are, calcareous earths, fluors or vitreous spars, quartz, and sand, fusible stones, as slates, basaltes, the several kinds of scoria, and pyrites.

Calcareous earth is used to facilitate the fusion of ores of iron, and of some of the poorer ores of copper, and, in general, of ores mixed with argillaceous earths, or with felt spar. This earth has been sometimes added with a view of separating the sulphur, to which it very readily unites: but by this union the sulphur is detained, and a hepar is formed, which readily dissolves iron and other metals, and so firmly adheres to them, that they cannot be separated without more difficulty than they could from the original ore. This addition is therefore not to be made till the sulphur be previously well expelled.

Fluors or *fusible spars* facilitate the fusion of most metallic minerals, and also of calcareous and argillaceous earths, of steatites, asbestus, and some other unfusible stones, but not of siliceous earths without a mixture of calcareous earth.

Quartz is sometimes added in the fusion of ferruginous copper ores, the use of which is said chiefly to be, to enable the ore to receive a greater heat, and to give a more perfect vitrification to the ferruginous scoria.

The *fusible stones*, as *slates*, *basaltes*, are so tenacious and thick when fused, that they cannot be considered properly as fluxes, but as matters added to lessen the too great liquidity of some very fusible minerals.

The *scoria* obtained in the fusion of an ore is frequently useful to facilitate the fusion of an ore of the same metal, and sometimes even ores of other metals.

Sulphurated pyrites greatly promote the fusibility of the scoria of metals, from the sulphur it contains. It is chiefly added to difficultly-fusible copper-ores, to form the sulphureous compounds called *matts*, that the ores,

Smelting of Ores of Silver.

ores thus brought into fusion may be separated from the adhering earthy matters, and that the ferruginous matter contained in them may be destroyed, during the subsequent calcination and fusion, by means of the sulphur.

As in the ores called *calciform*, the metallic matter exists in a calcined state; and as calcination reduces the metals of mineralised ores (excepting the perfect metals) to that state also; therefore all calciform and calcined ores require the addition of some inflammable substance to reduce them to a metallic state. In great works, the charcoal or other fuel used to maintain the fire produces also this effect.

Metals are sometimes added in the fusion of ores of other more valuable metals, to absorb from these sulphur or arsenic. Thus iron is added to sulphurated, cupreous, and silver ores. Metals are also added in the fusion of ores of other more valuable metals, to unite with and collect the small particles of these dispersed through much earthy matter, and thus to assist their precipitation. With these intentions lead is frequently added to ores and minerals containing gold, silver, or copper.

Ores of metals are also sometimes added to assist the precipitation of more valuable metals. Thus antimony is frequently added to assist the precipitation of gold intermixed with other metallic matters. Thus far of smelting of ores in general.

Sect. III. *Smelting of Ores of Silver.*

§ 1. As silver, even its proper ores, is always allayed with some other metals from which it is intended to be separated after the silver-ore has been well roasted, it must be mixed with a greater or less quantity of lead previous to its fusion.

Lead has the same effect in fusion of gold and silver as mercury has upon these metals by its natural fluidity; that is to say, it unites with them, and separates them from unmetallic matters, which, being lighter, rise always to the surface. But lead has the further advantage of procuring, by its own vitrification, that of all metallic substances, excepting gold and silver. Hence it follows, that when gold and silver are obtained by means of mercury, they still remain allayed with other metallic substances; whereas when they are obtained by fusion and scorification with lead, they are then pure, and not allayed with any metals but with each other.

In proportion as the lead, which has been united to the gold and silver of the ore, is scorified by the action of the fire, and promotes the scorification of the other metallic matters, it separates the perfect metals, and carries with it all the others to the surface. There it meets the unmetallic substances, which it likewise vitrifies, and which it changes into a perfect scoria, fluid, and such as a scoria ought to be to admit all the perfect metal contained in it to precipitate.

When all heterogeneous matters have been thus disengaged by scorification with lead, the perfect metals, to which some lead still remains united, are to be further purified by the ordinary operation of the cupel.

The common rule for the fusion and scorification of silver-ore with lead, is to add to the ore a quantity of lead so much greater as there is more matter to be scorified, and as these matters are more refractory and of more difficult fusion. Silver ores, or those treated as such, are often rendered refractory by ferruginous earths, pyritous matters, or cobalts, containing always a considerable quantity of an earth which is unmetallic, very subtile, and very refractory, and which renders a considerable augmentation of the quantity of lead necessary.

The quantity of lead which is commonly added to fusible silver ores, that do not contain lead, is eight times the quantity of the ore. But when the ore is refractory, it is necessary to add twelve times the quantity of lead, and even more; also glass of lead, and fluxes, such as the white and black fluxes; to which however borax and powder of charcoal are preferable, on account of the liver of sulphur formed by these alkaline fluxes.

It is necessary to observe, that saline fluxes are only used in small operations, on account of their dearness. To these are substituted, in the great operations, of which we now treat, sandiver, fusible scoria, and other matters of little value.

The greatest part of silver now employed in commerce is not obtained from the proper ores of silver, which are very scarce; but from lead and even copper ores, which are more or less rich in silver. To give an idea of the manner of treating these kinds of ores, from which silver is extracted in the great works, we shall briefly describe here, after Schlutter, the smelting of the ore of Ramelsberg, which contains, as we have already said, several different kinds of metals, but particularly lead and silver.

When this mineral has been disengaged from its sulphur as much as possible by three very long roastings, it is melted, in the Lower Hartz in Saxony, in a particular kind of furnace, called a *furnace for smelting upon a hollow or casse*. The masonry of this furnace is composed of large thick slates, capable of sustaining great heat, and cemented together by clay. The interior part of the furnace is three feet and a half long, and two feet broad at the back part, and one foot only in the front. Its height is nine feet eight inches. It has a foundation of masonry in the ground; and in this foundation channels are made for the evaporation of the moisture. These channels are covered over with stones called *covering stones*. The hollow or casse, which is made above these, is formed of bricks, upon which are placed, first, a bed of clay; then a bed of small ore and sifted vitriols; and, lastly, a bed of charcoal powder beat down, called *light brasque*. The anterior wall of the furnace is thinner than the others, and is called the *chemise*. The back wall, which is pierced to give passage to the pipes of two large wooden bellows, is called the *middle wall*. When the furnace is thus prepared, charcoal is thrown into the hollow, or casse; which being kindled, the fire is to be continued during three hours, before the matters to be fused are added. Then these matters are thrown in, which are not the pure ore, but a mixture of several substances, all of which are somewhat profitable. The quantity of these matters is sufficient for one day's work; that is, for a fusion of eighteen hours; and it consists of, 1. Twelve schorbens or measures of well roasted Ramelsberg ore (the schorben is a measure whose contents are two

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two feet five inches long, one foot seven inches broad, and a little more than a foot deep: it is equal to 32 quintals of that country. Cologn weight, at 123 pounds each quintal). 2. Six measures of scoria produced by the smelting of the ore of Upper Hartz, which is refractory, and what workmen call *cold*. 3. Two measures of knobben, which is an impure scoria containing some lead and silver, which has been formerly thrown away as useless, and is now collected by women and children. Besides these other matters are added, containing lead and silver, as the tests employed in refining, the dross of lead, impure litharge, and any rubbish containing metal, which was left in the furnace after the foregoing fusion. All these matters being mixed together, are thrown into the furnace: and to each measure of this mixture a measure of charcoal is added. The fusion is then begun by help of bellows; and as it proceeds, the lead falls through the light brasque or charcoal-bed into the hollow, or casse, where it is preserved from burning under the powder of charcoal. The scoria, on the other hand, being lighter and less fluid, is skimmed off from time to time by means of ladles, that it may not prevent the rest of the lead from falling down into the hollow. Thus, while the fusion lasts, fresh matters and fresh charcoal are alternately added, till the whole quantity intended for one fusion, or as they call it, one *day*, be thrown in.

There are several essential things to be remarked in this operation which is very well contrived. First, The mixture of matters from which a little lead and silver is procured, which would otherwise be lost; and which have also this advantage, that they retard the fusion of the Ramelsberg ore, which, however well roasted it has been, retains always enough of the sulphur and iron of the pyrites mixed with it, to render it too fusible or too fluid; so that without the addition of those matters nothing would be obtained but a matt. It is even necessary, notwithstanding these additions, not to hasten the fusion too much, but to give time for the ore to mix with other matters, else it would melt and flow of itself before the rest. Secondly, The fusion of the ore through charcoal which is practised in most smelting-houses, and for almost all ores, is an excellent method, the principal advantage of which is the saving of fuel. The action of the burning charcoal directed immediately upon the mineral, at the same time that it melts it more readily and efficaciously, also supplies it with the phlogiston necessary to bring it to a perfect state.

From the Ramelsberg ore after its first roasting a *white vitriol* is obtained and prepared at Goslar, whose basis was *zinc*: which proves that this ore contains also a certain quantity of this semimetal. As this ore is smelted in a country where the art is well understood of extracting every thing which a mineral contains, so in this fusion *zinc* and *cadmia* are obtained in the following manner: When the furnace is prepared for the fusion, it is necessary to close it up in the fore-part before the fusion is begun.

" First of all, a gritt-stone is to be placed, supported at the height of three inches. This stone is as long as the furnace is broad, and the height of it is level with the hole where the bellows-pipe enters. It is fastened to each side of the furnace, externally and internally with clay. Upon this stone a kind of receptacle, or, as it is called, the *seat of the zinc*, is made in the following manner: A flat flaty stone is chosen as long as the furnace is broad, and eight inches in breadth. This is placed on the gritt-stone abovementioned, in such a manner that it inclines considerably towards the front of the furnace, and that its bottom touches closely the gritt stone. It is fastened with clay, which is also laid upon the seat of the zinc. Upon this seat, which is to receive the zinc, two round peices of charcoal are placed, and also a stone called the *zinc-stone*, which is about a foot and an half in length, and closes one part of the front of the furnace. This stone also is fastened on each of its sides with clay. Clay is likewise put under the stone betwixt the two pieces of charcoal, which hinder it from touching the seat of the zinc. The under-part of this stone is but slightly luted, that the workmen may make an opening for the zinc to flow out. This is made the seat or receptacle of the zinc to detain this metallic substance, which would otherwise fall into the hottest part of the fire, called by the workmen the *melting place*, and would be there burnt whereas it is collected upon this receptacle during the fusion, where it is sheltered from the action of the bellows, and consequently from too great heat.

" When all the matter to be fused in one day is put into the furnace, the blast of air is continued till that matter has sunk down. When it is half way down the furnace, they draw out the scoria, that more of the ore and other matters may be exposed to the greatest heat. As soon as the scoria is coolled and fixed a little, two shovel-fulls of small wet scoria or sand is thrown close to the furnace, and beat down with the shovel; then the workmen open the seat or receptacle of zinc, and strike upon the zinc-stone to make the semimetal flow out. As soon as the purest part of it has flowed out, it is sprinkled with water and carried away. Then the workmen separate entirely the zinc-stone from the wall of the furnace, and they continue to give it little strokes, that the small particles of zinc dispersed among the charcoal by an iron fall down. This being done, the stone is removed; and the zinc is separated from the charcoal by an iron instrument, is cleaned, and remelted along with the zinc that flowed out at first, and is cast into round cakes. The reason why the zinc is withdrawn before the bellows cease to blow, is, that if it was left till the charcoal on the seat or receptacle was consumed, it would be mostly burnt, and little would be obtained. Thus after the zinc is withdrawn, the fusion is finished by blowing the bellows till the end."

Thus the zinc is separated from the ore of Ramelsberg, and is not confounded in the hollow or casse with the lead and silver, because, being a volatile semimetal, it cannot support the activity of the fire without rising into vapours, which are condensed in the place least hot, that is to say, upon the stones expressly prepared for that purpose; and which, being much thinner than the other walls of the furnace, are continually cooled by the external air.

It is also in this furnace, and after the fusion of the Ramelsberg ore, that the *cadmia of zinc*, or the *cadmia of furnaces*, is obtained. This ore is composed of sulphureous and ferruginous pyrites of true lead.

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lead-ore containing silver, and a very hard and compact matter of a dark brownish-grey colour, which is probably a *lapis calaminaris*, or an ore of zinc. These several matters of the Ramelsberg ore are not separated from each other, either for the roasting or for the fusion. Thus there is zinc in all the parts of the roasted ore; and much more of it would be obtained, if it was not so easily inflammable. All the zinc which is obtained is preserved from burning by falling, while in fusion, behind the chemise or fore-part of the furnace, which is, as has been said, a kind of schistus or slate, called by the workmen *steel-stone*. But the part of this semimetal which falls in the middle of the furnace, near the middle-wall, or towards the sides, being exposed to the greatest heat of the fire, is there burnt; and its smoke or flowers attaching itself on all sides to the walls of the furnace, undergo there a semi-fusion, which renders this matter so hard and so thick, that it must be taken away after every fourth fusion, or, at most, after every sixth fusion. That which is found attached to the highest part of the furnace is the best and purest. The rest is altered by a mixture of a portion of lead which it has carried up with it; and which, from its great weight and fixity, has hindered the zinc from rising so high as it would have done alone. Therefore, with this kind of impure cadmia, ductile brass cannot be made.

Almost all the zinc we have, as well as the cadmia of the furnaces, is obtained from the Ramelsberg ore by the process described, and consequently is not the produce of a pure ore of zinc or *lapis caliminaris*, which is never fused for that purpose. Before Mr Margraaf, although it was well known that this ore contained zinc, and that it was employed for the making of brass, a convenient process for extracting zinc from it was not known; because, when treated by fusion with fluxes, like other ores, it does not yield any zinc: which proceeds partly from the refractory quality of the earth contained in the calamine, that cannot be fused without a very violent fire; and also from the volatility and combustibility of the zinc, which for this reason cannot be collected at the bottom of a crucible, as a regulus under a scoria, like most metals.

M. Margraaf has remedied these inconveniences by distilling *lapis calaminaris*, mixed with charcoal, in a retort, to which is joined a receiver containing some water, and consequently in close vessels, where the zinc, by the help of a very strong fire indeed, is sublimed in its metallic form without burning. He also by the same method reduced into zinc the *flowers of zinc*, or *pompholix*, *cadmia of the furnace*, *tutty*, which is also a kind of cadmia; in a word, all matters capable of producing zinc by combination with phlogiston.—But it is evident that such operations as these are rather fit to supply proofs for chemical theory, than to be put in practice for works in great. M. Margraaf has observed, that the zinc which he obtained by this process was less brittle than what is obtained from the fusion of ores; which may proceed from its greater purity, or from its better combination with phlogiston.

Zinc is obtained, not only in the method used at Goslar above described; but is also extracted in great works, from *lapis calimaris* and calcined blend, by a distillation similar to that by which M. Margraaf has essayed ores of zinc. The first work of that kind was erected in Sweden by Mr Von Swab, in the year 1738. The ore employed was a kind of blend; this ore, when calcined, powdered, and mixed with charcoal, was put into iron or stone retorts, and the zinc was obtained by distillation. In Bristol a work is established in which zinc is obtained by distillation *by descent*.

Fining of Silver.

After this digression which we have now made concerning the operation in the great by which zinc and cadmia are obtained, and which we could not insert elsewhere, because of the necessary relation it has with the smelting of the Ramelsberg ore, we proceed to the other operations of the same ore; that is to say, to the *finery*, by which the silver is separated from the lead, which are mixed together, forming what is called the *work*.

This operation differs from the *fining of essay*, or *in small*, principally in this circumstance, that in the latter method of fining all the litharge is absorbed into the cupel, whereas in the former method the greatest part of this litharge is withdrawn.

The fining in great of the work of Ramelsberg is performed in a furnace called a *reverberatory furnace*. This furnace is so constructed that the flame of wood burning in a cavity called the *fire-place*, is determined by a current of air (which is introduced through the ash-hole, and which goes out at an opening on one side of that part of the furnace where the work is, that is, where the lead and silver are) to circulate above, and to give the convenient degree of heat, when the fire is properly managed. In this furnace a great cupel, called a *test*, is disposed. This test is made of the ashes of beech-wood, well lixivated in the usual manner. In some founderies different matters are added, as sand, spar, calcined gypsum, quicklime, clay. When the test is well prepared and dried, all the work is put at once upon the cold test, to the quantity of 64 quintals for one operation. Then the fire is lighted in the fire-place with faggots; but the fusion is not urged too fast, 1. That the test may have time to dry; 2. Because the work of the Ramelsberg ore is allayed by the mixture of several metallic matters, which it is proper to separate from it, otherwise they would spoil the litharge and the lead procured from it. These metallic matters are, copper, iron, zinc, and matt. As these heterogeneous substances are hard and refractory, they do not melt so soon as the work, that is, as the lead and silver: and when the work is melted, they swim upon its surface like a skin, which is to be taken off. These impurities are called the *scum* or the *first-waste*. What remains forms a second scum, which appears when the work is at its greatest degree of heat, but before the litharge begins to form itself. It is a scoria which is to be carefully taken off. It is called the *second waste*.

When the operation is at this point, it is continued by the help of bellows, the wind of which is directed, not upon the wood or fuel, but upon the very surface of the metal, by means of iron-plates put for that purpose before the blast-hole, which are called *papillons*. This blast does not so much increase the intensity of the fire, as it facilitates the combustion of the lead, and throws the litharge that is not imbibed by the test towards a channel, called the *litharge-way*, through which

Various processes for extracting Silver.

which it flows. The litharge becomes fixed out of the furnace: the matter which is found in the middle of the largest pieces, and which amounts to about a half or a third of the whole, is friable, and falls into powder like sand. This is put into barrels containing each five quintals of it; and is called *saleable litharge*, because it is sold in that state. The other part, which remains solid, is called *cold litharge*, and is again melted and reduced into lead. The fusion is called *cold fusion*, and the lead obtained from it *cold lead*, which is good and saleable when the work has been well cleared from the heterogenous matters mentioned above. The tests and cupels impregnated with litharge are added in the fusion of the ore, as we have already related.

When two-thirds, or nearly that quantity, of the lead are converted into litharge, no more of it is formed. The silver then appears covered with a white skin, which the finers call *lightening*, and the metal *lightened* or *fined silver*.

The silver obtained by this process of fining is not yet altogether pure. It still contains some lead, frequently to the quantity of four drams in each marc or eight ounces. It is delivered to the workmen, who complete its purification by the ordinary method. This last operation is the refining, and the workmen employed to do it are called *refiners*. A fining of 64 quintals of work, yields from 8 to 10 merks of fined silver, and from 35 to 40 quintals of litharge; that is from 12 to 18 of saleable litharge, from 22 to 23 of cold litharge, from 20 to 22 quintals of impregnated test, and from 6 to 7 quintals of lead-dross. The operation lasts from 16 to 18 hours.

§ 2. Ores containing silver may be divided into four kinds. 1. Pure, or those which are not much compounded with other metals. 2. Galenical, in which the silver is mixed with much galena, or ore of lead mineralised by sulphur. 3. Pyritous, in which the silver is mixed with the martial pyrites. 4. Cupreous, in which the silver is contained in copper ores. To extract the silver from these several kinds of ores, different operations are necessary.

Native silver is separated from its adhering earths and stones by amalgamation with mercury in the manner directed for the separation of gold; or by fusion with lead, from which it may be afterwards separated by cupellation.

Pure ores seldom require a previous calcination; but when bruised and cleansed from extraneous matters, may be fused directly, and incorporated with a quantity of lead; unless they contain a large proportion of sulphur and arsenic, in which case a calcination may be useful. The lead employed must be in a calcined or vitrified state, which being mixed with the ore, and gradually reduced by the phlogiston of the charcoal added to it, may be more effectually united with the silver of the ore, than if lead itself had been added, which would too quickly precipitate to the bottom of the containing vessel or furnace. The silver is to be afterwards separated from the lead by cupellation.

Galenical ores, especially those in which pyrites is intermixed, require a calcination, which ought to be performed in an oven, or reverberatory furnace. They are then to be fused together with some inflammable matter, as charcoal, by which the lead is revived, and together with the silver is precipitated.

Pyritous ores must be first melted, so as to form a matt. If the sulphur is not sufficient for this kind of fusion, more sulphurated pyrites may be added. This matt contains, besides silver and sulphur, also various metals, as lead, iron, and sometimes cobalt. The matt must be exposed to repeated calcination till the sulphur is dissipated. By these calcinations most of the iron is destroyed. The calcined matt is to be fused with litharge, and the silver incorporated with the revived lead; with which, and from the other imperfect metals with which it may be mixed, it must afterwards be separated by cupellation.

The silver contained in cupreous ores may be obtained, either, 1. By separating it from the copper itself, after this has been extracted along with the silver in the usual manner, from the ore; or, 2. By precipitating it immediately from the other matters of the ore.

1. It may be separated from the copper by two methods. One of these is by adding lead, and scorifying the imperfect metals. By this method much of the copper would be destroyed, and it is therefore not to be used unless the quantity of silver relatively to the copper be considerable. Another method by which silver may be separated from copper is by eliquation; that is, by mixing the mass of copper and silver with a quantity of lead, and applying such a heat as shall be just sufficient to make the lead eliquate from the copper, together with the silver, which being more strongly disposed to unite with the lead than with the copper, is thus incorporated with the former metal, and separated from the latter.

2. Silver may also be extracted from these cupreous ores by precipitation. For this purpose, let the ore, previously bruised and cleansed, be formed into a matt that the earthy matter may be well separated. Let the matt be then fused with a strong heat; and when the scoria has been removed, and the heat is diminished, add to it some clean galena, litharge, and granulated lead. When the fire has been raised, and the additions well incorporated with the matt, let some cast or filed iron be thrown into the liquid mass, which being more disposed than lead is to unite with sulphur will separate and precipitate the latter metal, and along with it the silver or gold contained in the matt. This method was introduced by Scheffer, and is practised at Adelfors in Smoland. In this work the proportion of the several materials is, four quintals of matt, two quintals of black copper containing some lead with the perfect metal, one quintal of galena one quintal of litharge, a fifth part of a quintal of granulated lead, and an equal quantity of cast iron.

The silver in this, and in all other instances where it is united with lead, is to be afterwards separated from the lead by cupellation; which process is described at the articles *Essay of the Value of Silver*, and Refining.

Sect. IV. *Smelting of Ores of Copper.*

§ 1. The smelting in great of copper ores, and even of several ores of silver and lead, excepting that of Ramelsberg, is performed in furnaces not essentially different

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ferent from that already described; but in this respect only, that the scoria and metal are not drawn out of the furnace, but flow spontaneously, as soon as they are melted, into receiving basons, where the metal is freed from the scoria. These furnaces are generally called *pierced furnaces*.

Instead of a light brasque, or bed of charcoal powder, under which the metal lies hid, the bottom of these furnaces is covered with a bason composed of heavy brasque, which is a mixture of charcoal-powder and clay. In the front of the furnace, and at the bottom of the chemise, there is a hole, called the *eye*, through which the melted matter flows and runs along a trench or furrow, called the *trace*, into one or more receiving basons made of earth, scoria, sand, &c. There the metal is separated from the scoria, by making it flow from these basons into another lateral one. These furnaces also are also called *crooked furnaces*.

Different names are given to them according to some difference in their construction. For instance, those which have two eyes, and two traces, through which the melted matter flows alternately into two basons, are called *spectacle-furnaces*. Their greater or less height gives occasion also to the distinction of *high furnaces* and *middle furnaces*.

The high furnaces are of modern invention. They were first introduced at Mansfield in the year 1727; and they are now used in almost all countries where ores are smelted, as in Saxony, Bohemia, Hungary, &c. Their chief advantage consists in simplifying and diminishing the labour. This advantage is effected by the great height of the furnace, which allows the ore to remain there a long time before it falls down into the hottest part of the fire and is melted. Consequently, it suffers successively different degrees of heat; and, before it is melted, it undergoes a roasting which costs nothing; therefore the high furnaces are chiefly employed for crude fusions; and particularly for the slate-copper ore. These furnaces are above 18 feet high. A too great height is attended with an inconvenience, besides the trouble of supplying it with ore and fuel, which is, that the charcoal is mostly consumed before it gets down where the greatest heat is required, and is then rendered incapable of maintaining a fire sufficiently intense.

All the furnaces which we have mentioned are supplied with large bellows, moved by the arbor of a wheel, which is turned round by a current of water.

The only kind of furnace for smelting ores where bellows are not employed, is what is called a *reverberatory furnace*. The Germans call it a *wind furnace*. It is also distinguished by the name of *English furnace*, because the invention of it is attributed to an English physician of the name of *Wright*, who was well versed in chemistry; and because the use of it was first introduced, in England about the end of the last century, where it is much employed, as well as in several other countries, as at Konigsberg, in Norway.

The length of these furnaces is about 18 feet, comprehending the masonry: their breadth is 12 feet, and their height nine feet and a half. The hearth is raised three feet above the level of the foundery: on one side is the fire-place, under which is an ash-hole hollowed in the earth; on the other side is a bason made, which is kept covered with fire when there is occasion: on the anterior side of this furnace there is a chimney, which receives the flame after it has passed over the mineral that is laid upon the hearth. This hearth, which is in the interior part of the furnace, is made of a clay capable of sustaining the fire. The advantage of this furnace is, that bellows are not necessary; and consequently it may be constructed where there is no current of water, and wherever the mine happens to be. This furnace has a hole in its front, through which the scoria is drawn out; and a bason, as we have said, on one side, made with sand, in which are oblong traces for the reception of the matt, and of the black copper, when they flow out of the furnace.

Copper is generally mineralised, not only by sulphur and arsenic, but also by semimetals and pyritous matters, and is frequently mixed with other metals. As this metal has great affinity with sulphur and arsenic, it is almost impossible to disengage it from them entirely by roasting: hence, in the smelting in great nothing is obtained by the first operation but a copper matt, which contains all the principles of the ore, excepting the earthy and stony parts, particularly when the ore is smelted crude and unroasted. Afterwards this matt must be again roasted and fused. The produce of this second fusion begins still more to resemble copper, but is not malleable. It continues mixed with almost all the minerals, particularly with the metals. As it is frequently of a black colour, it is always called *black copper*, when it is unmalleable, whatever its colour happens really to be.

As, of all the imperfect metals, copper is most difficultly burnt and scorified, it is again remelted several times, in order to burn and scorify the metallic substances mixed with it; and this is done till the copper is perfectly pure, which is then called *red* or *refined copper*, and these last fusions are called the *fining* and *refining* of it: red copper contains no metals but gold and silver, if any of these happened to be in the ore.

In order to avoid all these fusions, it has been proposed to treat in the humid way certain copper ores, particularly those which are very pyritous. This method consists in making the blue vitriol from the ore, by roasting and lixiviating it, and in precipitating pure copper from this lixivium, which is called *cement-water*, by means of iron: but it is not much practised, because it has been observed, that all the copper contained in the ore was not procured by this means.

As expence is not much regarded in small essays and experiments, these fusions are much abridged and facilitated by adding at first saline and glassy fluxes; and then by refining the black copper with lead in the cupel, as gold and silver are done. In this method of refining, it is to be most carefully observed, that the metal be fused as quickly as possible, and exposed to no more heat than is necessary, lest it be calcined.

When the black copper contains some iron, but not a great

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a great deal, the lead presently separates the iron from it, and makes it rise to the surface of the copper: but if the iron be in too large a proportion, it prevents the lead from uniting with the copper. These two phenomena depend on the same cause, which is, that lead and iron cannot unite.

Frequently copper ores contain also a quantity of silver sufficient to make its extraction by particular processes profitable. It was long before any process could be thought of for this purpose which was not too expensive and troublesome: but at length it is accomplished by the excellent operation called *eliquation*.

The copper from which silver has been separated by eliquation must be refined after this operation, as it is generally black copper from which silver is extracted: but even if it had not been black copper which was employed for this operation, it would require to be refined on account of a little lead it always retains. It is therefore carried to the refiner's furnace, when this operation is performed by help of bellows, the blast of which is thrown upon the surface of the melted metal. As in this refining of copper the precise time when it becomes pure cannot be known, because scoria is always formed on its surface, it is necessary to use an essay-iron, the polished end of which being dipt in melted copper, shows that this metal is pure when the copper adhering to the iron falls off as soon as it is dipt in cold water.

When this mark of the purity of the copper has been observed, its surface ought to be well cleaned; and as soon as it begins to fix, it must be sprinkled with a broom or besom dipped in cold water. The surface of the copper which is then fixing, being suddenly cooled by the water, detaches itself from the rest of the metal, is taken hold of by tongs, and is thrown red hot into cold water. By again sprinkling water on the mass of copper, it is all of it reduced into plates which are called *rosettes*, and these plates are what is called *rosette-copper*.

§ 2. The copper of pyritous cupreous ore cannot be obtained without several operations, which vary according to the nature of the ores. These operations are chiefly roastings and fusions. By the first fusion a matt is produced, which is afterwards to be roasted; and thus the fusions and roastings are to be alternately applied, till by the last fusion copper is obtained. These methods of treating pyritous copper ores depend on the two following facts: 1. Sulphur is more disposed to unite with iron than with copper. 2. The iron of these ores is destructible by the burning sulphur during the roasting of the fusion of the ores, while the copper is not injured. This fact appears from experiments mentioned by Scheffer and by Wallerius, and from the daily practice of smelting cuperous ores.

From these facts we learn, 1. That sulphur may be employed to separate and destroy iron mixed with copper. 2. That iron may be employed to separate the sulphur from copper, as is sometimes done in the essay of sulphurated copper-ores. 3. That by adjusting the proportion of the iron and sulphur to each other in the smelting of copper-ores, these two substances may be made to destroy each other, and to procure a separation of the copper: and this adjustment may be effected, by adding sulphur or sulphureous pyrites to the copper-ore, when the quantity of sulphur contained in this ore relatively to the iron is too small; or by adding iron when the sulphur predominates; or by roasting by which the superfluous sulphur may be expelled, and no more left than is sufficient for the destruction of the iron contained in the ore. We shall apply these principles to the following cases.

1. When the quantity of sulphur and of iron in a copper ore is small, and especially when the iron does not too much abound, a previous roasting will at once calcine the iron, and expel most of the sulphur; so that by one fusion the calcined iron may be scorified and black copper may be obtained. If the sulphur has not been sufficiently expelled, a second roasting and fusion are requisite; for the whole quantity of sulphur ought not to be expelled during the first roasting: but as much ought to be left as is sufficient for the scorification of the calcined iron; otherwise this might, during the fusion, be again revived and united with the copper.

2. If, in a copper ore, the quantity of iron be too great, relatively to the sulphur, some sulphurated pyrites, especially that kind which contains copper ought to be added, that a matt may be obtained, and that the iron may be calcined and scorified.

3. When the quantity of sulphur and iron is very great, that is, when the ore is very pyritous and poor it ought to be first formed into a matt; by which it is separated from the adherent earths and stones, and the bulk is diminished; then by repeated and alternate roastings and fusions, the copper may be obtained.

4. When the quantity of sulphur in an ore is greater than is sufficient for the forming a matt, the superfluous quantity ought to be previously expelled by roasting.

The copper thus at first obtained is never pure, but is generally mixed with sulphur or with iron. It is called *black copper*. This may be refined in furnaces, or on hearths.

In the former methods, to the copper when melted a small quantity of lead is added, which unites with the sulphur, and is scorified together with the iron, and floats upon the surface of the melted copper. This purification of copper by means of lead is similar to the refining of silver by cupellation; and is founded on the property of lead, by which it is more disposed to unite with sulphur than copper is; and on a property of copper, by which it is less liable than any other imperfect metal to be scorified by lead. But as copper is also capable of being scorified by lead, this operation must be longer continued, and no more lead must be employed, than is sufficient for the separation of the sulphur, and for the scorification of the iron.

The copper might also be purified from any remaining sulphur by adding a sufficient quantity of iron to engage the sulphur. Thus Mr Scheffer found, that by adding to sulphurated copper from $\frac{1}{20}$th to $\frac{1}{10}$th of old cast iron, he rendered the copper pure and ductile. See his Dissertation on the Parting of Metals amongst the *Swedish Memoirs* for the year 1752. In this purification, the quantity of iron added ought not to be too

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little, else all the sulphur will not be separated; and it ought not to be too great, else the superfluous quantity will unite and injure the purity of the copper. The fusion and scorification, with addition of lead, seems to be the best method for the last purification of copper.

Sect. V. *Smelting, &c. of Ores of Iron.*

Notwithstanding the great importance of this subject, and the labours of Reaumur, Swedenborgius and of some other authors, we have still a very imperfect knowledge of the causes of the differences of the several kinds of ores, of the methods of smelting best adapted to these differences, of the causes of the good and bad qualities of different kinds of iron, and of the means of so meliorating this metal, that we may obtain tough and ductile iron from any of its ores.

Swedenborgius has very industriously and exactly described the different processes now used in most parts of Europe for the smelting of ores of iron, for the forging of that metal, and for the conversion of it into steel: but we do not find that he or any other author have, by experiments and discoveries, contributed much to the illustration or to the improvement of this part of metallurgy, unless, perhaps, we except those of Mr Reaumur, concerning the softening of cast iron by cementation with earthy substances.

The ores of iron are known to vary much in their appearance, in their contents, in their degrees of fusibilty, in the methods necessary for the extraction of their contained metal, and in the qualities of the metal when extracted.

Most ores require to be roasted previously to their fusion; some more slightly, and others with a more violent and longer-continued fire. Those which contain much sulphur, arsenic, or vitriolic acid, require a long-continued and repeated roasting, that the volatile matters may be expelled. Of this kind is the black-iron ore, from which the Swedish iron is said to be obtained.

Some ores require a very slight roasting only, that they may be dried and rendered friable.—Such are the ores called *bog ores*, and others, which being in a calcined state, and containing little sulphureous matter, would, by a farther calcination, be rendered less capable of being reduced to a metallic state.

The roasting of ores of iron is performed by kindling piles, consisting of strata of fuel and of ore placed alternately upon one another, or in furnaces similar to those commonly employed for the calcination of limestone.

Some authors advise the addition of a calcareous earth to sulphureous ores during the roasting, that the sulphur may be absorbed by this earth when converted into quicklime. But we may observe that the quicklime cannot absorb the sulphur or sulphureous acid, till these be first extricated from the ore, and does therefore only prevent the dissipation of these volatile matters; and, secondly, that the sulphur thus united with the quicklime forms a hepar of sulphur, which will unite with and dissolve the ore during its fusion, and prevent the precipitation of the metal.

"The next operation is the *fusion* or *smelting* of the ore. This is generally performed in furnaces or towers, from 20 to 30 feet high, in the bottom of which is a bason for the reception of the fluid metal. When the furnace is sufficiently heated, which must be done at first very gradually, to prevent the cracking of the walls; a quantity of the ore is to be thrown in, from time to time, at the top of the furnace, along with a certain quantity of fuel and of lime-stone, or whatever other flux is employed. When the fuel below is consumed by the fire excited by the wind of the bellows, the ore, together with its proportionable quantity of fuel and of flux, sink gradually down, till they are exposed to the greatest heat in the furnace. There the ore and the flux are fused, the metallic particles are revived by the fuel, are precipitated by means of their weight through the scoria formed of the lighter earthy parts of the flux and of the ore, and unite in the bason at the bottom of the furnace, forming a mass of fluid metal covered by a glassy scoria. When a sufficient quantity of this fluid metal is collected, which is generally twice or thrice in 24 hours, an aperture is made, through which the metal flows into a channel or groove made in a bed of sand; and from thence into smaller lateral or connected channels, or other moulds. There it is cooled, becomes solid, and retains the forms of the channels or moulds into which it flows. The piece of iron formed in the large channel is called a *sow* and those formed in the smaller channels are called *pigs*. Sometimes the fluid iron is taken out of the furnace by means of ladles, and poured into moulds ready prepared, of sand or of clay, and is thus formed into the various utensils and instruments for which cast iron is a proper material.

The *scoria* must be, from time to time, allowed to flow out, when a considerable quantity of it is formed through an aperture made in the front of the furnace for that purpose. A sufficient quantity of it must, however, be always left to cover the surface of the melted iron, else the ore which would fall upon it, before the separation of its metallic from its unmetallic parts, would lessen the fluidity and injure the purity of the melted metal. This scoria ought to have a certain degree of fluidity; for if it be too thick, the revived metallic particles will not be able to overcome its tenacity, and collect together into drops, nor be precipitated. Accordingly, a scoria not sufficiently fluid, is always found to contain much metal. If the scoria be too thin, the metallic particles of the ore will be precipitated before they are sufficiently metallised, and separated from the earthy and unmetallic parts. A due degree of fluidity is given to the scoria by applying a proper heat and by adding fluxes suited to the ore.

Some ores are fusible without addition, and others cannot be smelted without the addition of substances capable of facilitating their fusion.

The *fusible ores* are those which contain sulphur, arsenic, or are mixed with some fusible earth.

The *ores difficultly fusible* are those which contain no mixture of other substance. Such are most of the ores

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ores which contain iron in a ſtate nearly metallic. As iron itſelf, when purified from all heterogeneous matters, is ſcarcely fuſible without addition, ſo the metal contained in theſe purer kinds of ores cannot be eaſily extracted without the addition of ſome fuſible ſubſtance. 1. Thoſe which are mixed with ſome very refractory ſubſtance. Some of theſe refractory ores contain arſenic; but as this ſubſtance facilitates the fuſion of ores, we may preſume that their refractory quality depends upon a mixture of ſome unmetallic earth or other infuſible ſubſtance. The earth which is mixed with the common calciform ores is in conſiderable quantity; and is ſometimes calcareous, ſometimes ſiliceous, and ſometimes argillaceous.

Perhaps the fuſibility of different ores depends greatly on the degree of calcination to which the metal contained in them has been reduced; ſince we have reaſon to believe, that by a very perfect calcination, ſome metals at leaſt may be reduced to the ſtate of an earth almoſt unfuſible, and incapable of metalliſation; and ſince we know, that in every calcination and ſubſequent reduction of a given quantity of any imperfect metal, a ſenſible part of that quantity is always loſt or deſtroyed, however carefully theſe operations may have been performed. That ſome of theſe ores are already too much calcined, appears from the inſtance abovementioned of the *bog ores*, which are injured by roaſting; and even the great height of the common ſmelting furnaces, although advantageous to many ores that require much roaſting, is ſaid to be injurious to thoſe which are already too much calcined, by expoſing them to a further calcination, during their very gradual deſcent, before they arrive at the hotteſt part of the furnace, where they are fuſed.

But as too violent calcination renders ſome ores difficultly fuſible, ſo too ſlight calcination of other ores injures the purity of the metal, by leaving much of the ſulphureous or other volatile matter, which ought to have been expelled.

Various *ſubſtances are added to aſſiſt the fuſion of ores difficultly fuſible.* Theſe are, 1. *Ores* of a fuſible quality, or which, being mixed with others of a different quality, become fuſible: accordingly, in the great works for ſmelting ores of iron, two or more different kinds of ore are commonly mixed, to facilitate the fuſion, and alſo to meliorate the quality of the iron. Thus an ore yielding an iron which is brittle when hot, which quality is called *red-ſhort*, and another ore which produces iron brittle when cold, or *cold-ſhort*, are often mixed together; not, as ſometimes ſuppoſed, that theſe qualities are mutually deſtructive of each other, but that of each of them is diminiſhed in the mixed maſs of iron, as much as this maſs is larger than the part of the maſs originally poſſeſſed of that quality. Thus, if from two ſuch ores the maſs of iron obtained conſiſts of equal parts of cold-ſhort, and of red-ſhort iron, it will have both theſe qualities, but will be only half as *cold-ſhort* as iron obtained ſolely from one of the ores, and half as *red-ſhort* as iron obtained only from the other ore. 2. *Earths* and *ſtones* are alſo generally added to facilitate the fuſion of iron ores. Theſe are ſuch as are fuſible, or become fuſible when mixed with the ore, or with the earth adhering to it. Authors direct that, if this earth be of an argillaceous nature, limeſtone or ſome calcareous earth ſhould be added; and that, if the adherent earth be calcareous, an argillaceous or ſiliceous earth ſhould be added; becauſe theſe two earths, though ſingly unfuſible, yet, when mixed, mutually promote the fuſion of each other: but as limeſtone is almoſt always added in the ſmelting of iron ores, and as in ſome of theſe, at leaſt, no argillaceous earth appears to be contained, we are inclined to believe that it generally facilitates the fuſion, not merely by uniting with thoſe earths, but by uniting with that part of the ore which is moſt perfectly calcined, and leaſt diſpoſed to metalliſation; ſince we know, that by mixing a calciform or roaſted ore of iron with calcareous earth, without any inflammable matter, theſe two ſubſtances may be totally vitrified. See *Experiments made upon quicklime and upon iron, by Mr Brandt, in the Swediſh Memoirs for the years* 1749 *and* 1751. Calcareous earth does indeed ſo powerfully facilitate the fuſion of iron ores, that it deſerves to be conſidered whether workmen do not generally uſe too great a quantity of it, in order to haſten the operation. For when the ſcoria is rendered too thin, much earthy or unmetallized matter is precipitated, and the caſt iron produced is of too vitreous a quality, and not ſufficiently approximated to its true metallic ſtate.

Some authors pretend, that a principal uſe of the addition of limeſtone in the ſmelting of iron ores is to abſorb the ſulphur, or vitriolic acid, of theſe ores: but, as we have already obſerved, a hepar of ſulphur is formed by that mixture of calcareous earth and ſulphur, which is capable of diſſolving iron in a metallic ſtate; and thus the quantity of metal obtained from an ore not ſufficiently diveſted of its ſulphur, or vitriolic acid, (which, by uniting with the fuel, is formed into a ſulphur during the ſmelting), muſt be conſiderably diminiſhed, though rendered purer, by addition of calcareous earth: hence the utility appears of previouſly expelling the ſulphur and vitriolic acid from the ore by a ſufficient roaſting. 3. The *ſcoria* of former ſmeltings is frequently added to aſſiſt the fuſion of the ore; and, when the ſcoria contains much iron, as ſometimes happens in ill-conducted operations, it alſo increaſes the quantity of metal obtained.

The quantity of theſe fuſible matters to be added varies according to the nature of the ore; but ought in general to be ſuch, that the ſcoria ſhall have its requiſite degree of thinneſs, as is mentioned above.

The *fuel* uſed in moſt parts of Europe for the ſmelting of ores of iron is charcoal. Lately, in ſeveral works in England and Scotland, iron ore has been ſmelted by means of pit-coal, previouſly reduced to cinders or *coaks*, by a kind of calcination ſimilar to the operation for converting wood into charcoal, by which the aqueous and ſulphureous parts of the coal are expelled, while only the more fixed bituminous parts are left behind. In France, pit-coal not calcined has been tried for this purpoſe, but unſucceſsfully. The uſe of *peat* has alſo been introduced in ſome parts of England.

The quality of the iron depends conſiderably upon the quality and alſo upon the quantity of the fuel employed. Charcoal is fitter than coaks for producing

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ducing an iron capable of being rendered malleable by forging.

The quantity of fuel, or the intenſity of the heat, muſt be ſuited to the greater or leſs fuſibility of the ore. Sulphureous, and other ores eaſily fuſible, require leſs fuel than ores difficultly fuſible. In general, if the *quantity of fuel be too ſmall*, and the heat not ſufficiently intenſe, all the iron will not be reduced, and much of it will remain in the ſcoria, which will not be ſufficiently thin. This defect of fuel may be known by the blackneſs and compactneſs of the ſcoria; by the qualities of the iron obtained, which in this caſe is hard, white, light, intermixed with ſcoria, ſmooth in its texture, without ſcales or grains, rough and convex in its ſurface, and liable to great loſs of weight by being forged; and, laſtly, it may be known by obſerving the colour and appearance of the drops of metal falling down from the ſmelted ore, and of the ſcoria upon the furnace of the fluid metal, both which are darker coloured than when more fuel is uſed. When the *quantity of the fuel is ſufficiently large*, and the heat is intenſe enough, the iron is darker coloured, denſer, more tenacious, contains leſs ſcoria, and is therefore leſs fuſible, and loſes leſs of its weight by being forged. Its ſurface is alſo ſmoother and ſomewhat concave; and its texture is generally granulated. The ſcoria, in this caſe, is of a lighter colour, and leſs denſe. The drops falling down from the ſmelted ore and the liquid ſcoria in the furnace appear hotter and of a brighter colour. When the quantity of fuel is too great, and the heat too intenſe, the iron will appear to have a ſtill darker colour, and more conſpicuous grains or plates, and the ſcoria will be lighter, whiter, and more ſpongy. The drops falling from this ſmelted ore, and the fluid ſcoria will appear to a perſon looking into the furnace through the blaſt-hole to be very white and ſhining hot. The quantity of charcoal neceſſary to produce five hundred weight of iron, when the ore is rich, the furnace well contrived, and the operation ſkilfully conducted, is computed to be about 40 cubic feet; but is much more in contrary circumſtances.

The *time during which the fluid metal ought to be kept in fuſion* before it is allowed to flow out of the furnace, muſt alſo be attended to. How long that time is, and whether it ought not to vary according to the qualities of ores and other circumſtances, we cannot determine. In ſome works the metal is allowed to flow out of the furnace every ſix or eight, and in others only every 10 or 12, hours. Some workmen imagine, that a conſiderable time is neceſſary for the concoction of the metal. This is certain, that the iron undergoes ſome change by being kept in a fluid ſtate; and that if its fuſion be prolonged much beyond the uſual time, it is rendered leſs fluid, and alſo its coheſion, when it becomes cold, is thereby greatly diminiſhed. The marquis de Courtivron ſays, that the coheſion may be reſtored to iron in this ſtate by adding to it ſome vitreſcible earth, which he conſiders as one of the conſtituent parts of iron, and which he thinks is deſtroyed by the fuſion too long continued. That the fuſibility of caſt-iron does depend on an admixture of ſome vitreſcible earth, appears probable from the great quantity of ſcoria forced out of iron during its converſion into malleable or forged iron, and from the loſs of fuſibility which it ſuffers nearly in proportion to its loſs of ſcoria. The quantity of iron daily obtained from ſuch a furnace as is above deſcribed, is from two to five tons in 24 hours, according to the richneſs and fuſibility of the ore, to the conſtruction of the furnace, to the adjuſtment of the due quantity of flux and of fuel, and to the ſkill employed in conducting the operation.

The *quality of the iron* is judged of by obſerving the appearances during its flowing from the furnace, and when it is fixed and cold. If the fluid iron, while it flows, emits many and large ſparkles; if many brown ſpots appear on it while it is yet red-hot; if, when it is fixed and cold, its corners and edges are thick and rough, and its ſurface is ſpotted; it is known to have a red-ſhort quality. If, in flowing, the iron ſeems covered with a thin glaſſy cruſt, and if, when cold, its texture be whitiſh, it is believed to be cold-ſhort. Mr Reaumur ſays, that dark-coloured caſt iron is more impure than that which is white. The marquis de Courtivron is of a contrary opinion. But no certain rules for judging of the quality of iron before it be forged can be given. From brittle caſt iron, ſometimes ductile forged iron is produced. Caſt-iron with brilliant plates and points, when forged, becomes ſometimes red-ſhort and ſometimes cold-ſhort. Large ſhining plates, large cavities called *eyes*, want of ſufficient denſity, are almoſt certain marks of bad iron; but whether it will be cold or red ſhort cannot be affirmed till it be forged. Whiteneſs of colour, brittleneſs, cloſeneſs of texture, and hardneſs, are given to almoſt any caſt iron by ſudden cooling; and we may obſerve, that in general the whiter the metal is, the harder it is alſo, whether theſe properties proceed from the quality of the iron, or from ſudden cooling; and that, therefore, the darker-coloured iron is fitter for being caſt into moulds, becauſe it is capable in ſome meaſure of being filed and poliſhed, eſpecially after it has been expoſed during ſeveral hours to a red-heat in a reveberatory furnace, and very gradually cooled. This operation, called by the workmen *annealing*, changes the texture of the metal, renders it ſofter and more capable of being filed than before, and alſo conſiderably leſs brittle.

Mr Reaumur found, that by cementing caſt iron with abſorbent earths in a red-heat, the metal may be rendered ſofter, tougher, and conſequently a fit material for many utenſils formerly made of forged iron. Whether cementation with abſorbent earths gives to caſt iron a greater degree of theſe properties than the annealing commonly practiſed, has not been yet determined.

In Navarre, and in ſome of the ſouthern parts of France, iron-ore is ſmelted in furnaces much ſmaller, and of a very different conſtruction from thoſe above deſcribed. A furnace of this kind conſiſts of a wide-mouthed copper-caldron, the inner ſurface of which is lined with maſonry a foot thick. The mouth of this caldron is nearly of an oval or elliptic form. The ſpace or cavity contained by the maſonry is the furnace in which the ore is ſmelted. The depth of this cavity is equal to two feet and a half: the larger diameter of the oval mouth of the cavity is about eight feet, and its ſmaller diameter is about ſix feet: the ſpace of the furnace is gradually contracted towards the bottom;

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bottom, the greateſt diameter of which does not exceed ſix feet: eighteen inches above the bottom is a cylindrical channel in one of the longer ſides of the caldron and maſonry, through which the nozzle of the bellows paſſes. This channel, and alſo the bellows pipe, are ſo inclined, that the wind is directed towards the loweſt point of the oppoſite ſide of the furnace. Another cylindrical channel is in one of the ſhorter ſides of the furnace, at the height of a few inches from the bottom, which is generally kept cloſed, and is opened occaſionally to give paſſage to the ſcoria: and above this is a third channel in the ſame ſide of the furnace, through which an iron inſtrument is occaſionnally introduced to ſtir the fluid metal, and to aſſiſt, as is ſaid, the ſeparation of the ſcoria from it. The greateſt height of this channel is at its external aperture on the outſide of the furnace, and its ſmaller height is at its internal aperture; ſo that the inſtrument may be directed towards the bottom of the furnace; but the ſecond channel below it has a contrary inclination, that, when an opening is made, the ſcoria may flow out of the furnace into a baſon placed for its reception. When the furnace is heated ſufficiently, the workmen begin to throw into it alternate changes of charcoal and of ore previouſly roaſted. They take care to throw the charcoal chiefly on that ſide at which the wind enters, and the ore at the oppoſite ſide. At the end of about four hours, a maſs of iron is collected at the bottom of the furnace, which is generally about 600 weight; the bellows are then ſtopt; and then the maſs of iron is become ſolid, the workmen raiſe it from the bottom of the furnace, and place it, while yet ſoft, under a large hammer, where it is forged. The iron produced in theſe furnances is of the beſt quality; the quantity is alſo very conſiderable, in proportion to the quantity of ore, and to the quantity of fuel employed. In theſe furnaces no limeſtone or other ſubſtance is uſed to facilitate the fuſion of the ore. We ſhould receive much inſtruction concerning the ſmelting of iron-ore, if we knew upon what part of the proceſs, or circumſtance, the excellence of the iron obtained in theſe furnaces depends; whether on the quality of the ore; on the diſuſe of any kind of flux, by which the proportion of vitreous or earthy matter, intermixed with the metallic particles, is diminiſhed; on the forging while the iron is yet ſoft and hot, as the Marquis de Courtivron thinks; or on ſome other cauſe, not obſerved.

The iron thus produced by ſmelting ores is very far from being a pure metal; and though its fuſibility renders it very uſeful for the formation of cannon, pots, and a great variety of utenſils, yet it wants the ſtrength, toughneſs, and malleability, which it is capable of receiving by further operations.

Caſt-iron ſeems to contain a large quantity of vitreous or earthy matter mixed with the pure iron; which matter is probably the chief cauſe of its fuſibility, brittleneſs, hardneſs, and other properties by which it differs from forged iron. The ſulphur, arſenic, and other impurities of the ore, which are ſometimes contained in caſt-iron, are probably only accidental, and may be the cauſes of the red-ſhort quality, and of other properties of certain kinds of iron: but the earthy matter abovementioned ſeems principally to diſtinguiſh caſt-iron from forged or malleable iron; for, firſt, by depriving the former of this earthy matter, it is rendered malleable, as in the common proceſs hereafter to be deſcribed; and, ſecondly, by fuſing malleable iron with earthy and vitreſcible matters, it loſes its malleability, and is reſtored to the ſtate and properties of caſt-iron.

The earthy vitreous matter contained in caſt-iron conſiſts probably of ſome of the ferruginous earth or calx of the ore not ſufficiently metalliſed, and alſo of ſome unmetallic earth. Perhaps it is only a part of the ſcoria which adheres to, and is precipitated with, the metallic particles, from which it is more and more ſeparated, as the heat applied is more intenſe, and as the fuſion is longer continued.

To ſeparate theſe impurities from caſt-iron, and to unite the metallic parts more cloſely and compactly, and thus to give it the ductility and tenacity which render this metal more uſeful than any other, are the effects produced by the following operations.

The firſt of theſe operations is a fuſion of the iron, by which much of its impurities is ſeparated in form of ſcoria; and by the ſecond operation, a further and more complete ſeparation of theſe impurities, and alſo a cloſer compaction of the metallic particles, are effected by the application of mechanical force or preſſure, by means of large hammers.

Some differences in the conſtruction of the forge or furnace, in which the *fuſion* or *refining of caſt-iron* is performed, in the method of conducting the operation, and in other circumſtances, are obſerved to occur in different places. We ſhall deſcribe from Swedenborgius the *German method.*

The fuſion of the caſt-iron, which is to be rendered malleable, is performed upon the hearth of a forge ſimilar to that uſed by blackſmiths: at one ſide of this hearth is formed a cavity or fire-place, which is intended to contain the fuel and the iron to be melted: this fire-place is 20 inches long, 18 inches broad, and 12 or 14 inches deep: it is bounded on three ſides by three plates of caſt-iron placed upright; and on the fourth ſide, which is the front, or that part neareſt to which the workman ſtand, by a large forge-hammer, through the eye of which the ſcoria is at certain times allowed to flow. The floor alſo of the fire-place is another caſt-iron plate. The thickneſs of theſe plates is from two to four inches. One of the upright ſide-plates reſts againſt a wall, in an apertures through which a copper-tube, called the *tuyere*, is luted with clay. This tube is a kind of caſe or covering for the pipe of a pair of bellows placed behind the wall, and its direction is therefore parallel to that of the bellows-pipe; but it advances about half a foot further than this pipe into the fire-place; and thus gives greater force to the air, which it keeps concentrated, or prevents the divergency of the air till it is required to act. The tube reſts upon the edge of the ſide-plate which leans againſt the wall, nearer to the back-part than to the front of the fire-place; and in ſuch an oblique direction, that the wind ſhall be impelled towards the furtheſt part of the floor of the fire-place, or where this floor is interſected by the oppoſite ſide-plate. The obliquity of the tuyere ought to vary according to the quality of the iron: and therefore, in every operation, it may be ſhifted till its proper poſition is found. The more nearly its direction approaches

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proaches to a horizontal plane, the more intenſe is the heat; but a larger quantity of fuel is conſumed than is even proportional to the increaſe of heat, becauſe the flame is not then ſo well confined. When the iron is eaſily fuſible, great heat is not required: the tuyere may then decline conſiderably from the horizontal plane, and thus fuel may be ſaved. This tuyere, tho' made of copper, a metal more eaſily fuſible than iron, is preſerved from fuſion by the conſtant paſſage of cold air through it. It muſt be carefully kept open, and cleanſed from the ſcoria, which would be apt to block up its cavity, by which not only the heat would be too much diminiſhed for the ſucceſs of the operation, but the tube itſelf would be melted.

To prepare for the fuſion, a quantity of ſcoria of a former operation is thrown into the fire-place, till one third-part of this be full; and the remaining two thirds of the fire-place are to be filled with ſmaller ſcoria, coal-duſt, and ſparks ejected from hot iron.—Theſe matters, being fuſible, form a bath for the reception of the iron when melted. Upon this bed of ſcoria, the maſs of caſt iron to be melted is placed; ſo that one end of it ſhall be within the fire-place, oppoſite to the tuyere, and at the diſtance of about four or five inches from its aperture; and the other end ſhall ſtand without the fire-place, to be puſhed in, as the former is melted. The upper ſide of the maſs of iron ought to be in the ſame horizontal plane as the upper part of the orifice of the tuyere, that the wind may, by means of the obliquity of its courſe, ſtrike upon and paſs along the under-ſide of the maſs; but if the iron be difficultly fuſible, the tuyere is to be diſpoſed more horizontally, ſo that the wind ſhall ſtrike directly upon the maſs of iron; and that one part of the blaſt ſhall graze along the upper ſurface, and the other part along the under ſurface of the iron. The maſs of iron weighs generally from 200 to 400 pounds. Sometimes two or three ſmaller maſſes are put one above another, ſo as not to touch. When theſe are of different qualities, the cold-ſhort piece is placed undermoſt, that being more unfuſible than the red-ſhort. The iron being placed, charcoal-powder is thrown on both ſides, and coals are accumulated above, ſo as to cover entirely the iron.

The coals are then to be kindled, and the bellows are made to blow, at firſt ſlowly, and afterwards with more and more force. The iron is gradually liquefied, and flows down in drops through the melted ſcoria to the bottom of the fire-place; during which the workmen frequently turn the iron, ſo that the end oppoſed to the blaſt of wind may be equally expoſed to heat, and uniformly fuſed. While the coals are conſumed, more are thrown on, ſo that the whole may be kept quite covered. During the operation, a workman frequently ſounds the bottoms and corners of the fire-place by means of a bar or poker, raiſes up any maſs of metal which he finds adhering to theſe, and expoſes them to the greateſt heat, that they may be more perfectly fuſed.

When all the iron is fuſed, no more coals are to be added; but the melted maſs is to remain half uncovered for ſome time; during which the iron boils and bubbles, and its ſurface ſwells and riſes higher and higher. When the iron has riſen as high as the upper edge of the fire-place, the coals upon its ſurface muſt be removed; and by thus expoſing it to cold air, its ebullition and ſwelling ſubſide. In this ſtate, or coction, the iron is kept during half an hour or more, by adding occaſionally pieces of good coal, which maintain a ſufficient heat, without covering entirely the ſurface of the maſs. During this coction, the workmen allow the orifice of the tuyere to be half ſtopped up by the ſcoria, that the air may not blow upon the iron with all its force, by which it would be too much cooled. Accordingly, when they think that the coction has continued ſufficiently long, they clear the paſſage of the tuyere, and the maſs is ſoon cooled by the cold air. At the ſame time alſo they open a paſſage in the eye of the hammer placed in the front of the fire-place, through which ſome of the ſcoria is allowed to flow out. When the iron has become ſolid, the bellows are ſtopt, the coals are removed, and the maſs is left during an hour; and then the workmen raiſe it from the fire-place, turn it upſide down, and proceed to the ſecond coction or fuſion of the iron.

From this ſecond operation, the maſs is to be ſo placed, that one part of it ſhall reſt upon the tuyere, and the other upon the ſcoria remaining in the fire-place. This ſcoria is to be diſpoſed in an oblique direction parallel to the tuyere, by which means the wind of the bellows is obliged to paſs along the under ſide of the maſs of iron. About the ſides of the maſs, charcoal-powder and burnt aſhes are thrown; but towards the tuyere, dry and entire pieces of coals are placed, to maintain the fire. When theſe are kindled, more coals are added, and the fire is gradually excited. The workman attends to the direction of the flame, that it paſs equally along the under ſurface of the iron, quite to the further extremity, and that it do not eſcape at the ſides, nor be reverberated back towards the tuyere, by which this copper tube might be melted. During this fuſion, pieces of iron are apt to be ſeparated from the maſs, and to fall down unfuſed to the bottom and corners of the fire-place. Theſe are carefully to be ſearched for, and expoſed to the greateſt heat till they are melted. When the whole maſs is thus brought into perfect fuſion, the coals are removed; and the wind blowing on its ſurface, whirls and diſſipates the ſmall remaining pieces of ſcoria and ſparks thrown out from the fluid iron. This jet of fire continues about ſeven or eight minutes, and the whole operation about two hours. In this ſecond fuſion the ſcoria is to be thrice removed, by opening a paſſage through the eye of the hammer. The firſt time of removing the ſcoria is about 20 minutes from the kindling of the fire, the ſecond time is about 40 minutes after the firſt, and the third time is near the end of the operation.

The maſs is then removed from the hearth, and put upon the ground of the forge, where it is cleanſed from ſcoria, and beat into a more uniform ſhape. It is then placed on an anvil, where, by being forged, it receives a form nearly cubical. This maſs is to be divided into five, ſix, or more pieces, by means of a wedge; and theſe are to be heated and forged till they are reduced to the form of the bars commonly ſold.

In ſome forges, the iron is fuſed only once, and in others it ſuffers three fuſions, by which it is ſaid to be rendered

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rendered very pure. Where only one fusion is practised, it is called the *French method*. In this, no greater quantity of iron is fused at once than is sufficient to make one bar. The fire-place is of considerably less dimensions, and especially is less deep, than in the German method above described. The fire is also more intense, and the proportion of fuel consumed to the iron is greater. The iron, when melted, is not kept in a state of ebullition as is above described; but this ebullition is prevented by stirring the fluid mass with an iron bar, till it is coagulated, and becomes solid.

By these operations, fusion and forging, the iron loses about $\frac{3}{10}$ parts of its former weight, sometimes more and sometimes less, according to the quality of the cast-iron employed; it is purified from the vitreous and earthy parts which were intermixed with it, its metallic particles are more closely compacted, its texture is changed, and it is rendered more dense, soft, and malleable, tough, and difficultly fusible.

The degrees, however, of these qualities vary much in different kinds of iron. Thus some iron is tough and malleable, both when it is hot and when it is cold. This is the best and most useful iron. It may be known generally by the equable surface of the forged bar, which is free from transverse fissures or cracks in the edges, and by a clear, white, small-grained, or rather fibrous texture. Another kind is tough when it is heated, but brittle when it is cold. This is called *cold-short* iron: and is generally known by a texture consisting of large, shining plates, without any fibres. It is less liable to rust than other iron. A third kind of iron, called *red short*, is brittle when hot, and malleable when cold. On the surface and edges of the bars of this kind of iron, transverse cracks or fissures may be seen; and its internal colour is dull and dark. It is very liable to rust. Lastly, some iron is brittle both when hot and when cold.

Most authors agree, that the red-short quality of iron proceeds from some sulphur or vitriolic acid being contained in it, because sulphur is known to produce this effect when added to iron, and because the iron obtained from pyritous and other sulphurated ores has generally this quality.

The cause of the cold-short quality of iron is not so well ascertained. Some imagine, that it proceeds from a mixture of arsenic or of antimony. But this opinion seems to be improbable, when we consider that these metallic substances may in a great measure be dissipated by roasting, whereas the ores which yield a cold-short iron are injured by much roasting; that no arsenic or antimony are observable in most, if in any, of these ores; and lastly, that these semimetals would render the iron brittle both when hot and when cold. Cramer and other authors impute this vicious quality to a mixture of unmetallic earth or vitreous matter; and affirm, that it may be destroyed by cementation with phlogiston, and by forging. And lastly, others ascribe the cold-short quality of iron to a defect of phlogiston, or, as Swedenborgius says, of sulphur. To ascertain the causes of the bad qualities of iron, and to discover practical remedies, are still desiderata in metallurgy.

In one bar frequently two or more different kinds of iron may be observed, which run all along its whole length; and scarcely a bar is ever found of entirely pure and homogeneous iron. This difference probably proceeds from the practice we have mentioned of mixing different kinds of ores together, in the smelting; and also from the practice of mixing two or more pigs, of cast iron of different qualities in the finery of these; by which means, the red-short and cold-short qualities of the different kinds are not, as we have already remarked, mutually counteracted or destroyed by each other, but each of these qualities is diminished in the mixed mass of iron, as much as this mass is larger than the part of the mass originally possessed of that quality: that is, if equal parts of red short and of cold-shot iron be mixed together, the mixed mass will be only half as red-short as the former part, and half as cold-short as the latter. For these different kinds of iron seem as if they were only capable of being interwoven and diffused through each other, but not of being intimately united or combined.

The quality of forged iron may be known by the texture which appears on breaking a bar. The best and toughest iron is that which has the most fibrous texture, and is of a clear greyish colour. This fibrous appearance is given by the resistance which the particles of the iron make to their rupture. The next best iron is that whose texture consists of clear, whitish, small grains, intermixed with fibres. These two kinds are malleable, both when hot and when cold, and have great tenacity. *Cold-short iron* is known by a texture consisting of large, shining plates, without fibres: and *red-short iron* is distinguished by its dark dull colour, and by the transverse cracks and fissures on the surface and edges of the bars. The quality of iron may be much improved by violent compression, as by forging and rolling; especially when it is not long exposed to too violent heat, which is known to injure, and at length to destroy, its metallic properties.

For the conversion of iron into *steel*, see the article Steel.

Sect. VI. *Of the Smelting of Tin Ores.*

Smelting of Tin Ores.

The tin-ores commonly smelted are those which consist of calx of tin combined with calx of arsenic and sometimes with calx of iron. These are either pure, as the tin-grains, or intermixed with spars, stones, pyrites, ores of copper, iron, or of other metals.

The impure ores must be cleansed as much as is possible from all heterogeneous matters. This cleansing is more necessary in ores of tin than of any other metal; because in the smelting of tin-ores a less intense heat must be given than is sufficient for the scorification of earthy matters, lest the tin be calcined. Tin-ores previously bruised may be cleansed by washing, for which operation their great weight and hardness render them well adapted. If they be intermixed with very hard stones or ferruginous ores, a slight roasting will render these impure matters more friable, and consequently fitter to be separated from the tin-ores. Sometimes these operations, the roasting, contusion, and lotion, must be repeated. By roasting, the ferruginous particles are so far revived, that they may be separated by magnets.

Smelting of Ores of Lead.

The ore, thus cleanſed from adhering heterogeneous matters, is to be roaſted in an oven or reverberatory furnace, with a fire rather intenſe than long continued; during which it muſt be frequently ſtirred to prevent its fuſion. By this operation, the arſenic is expelled, and in ſome works is collected in chambers built purpoſely above the calcining furnace.

Laſtly, the ore cleanſed and roaſted is to be fuſed, and reduced to a metallic ſtate. In this fuſion, attention muſt be given to the following particulars. 1. No more heat is to be applied than is ſufficient for the reduction of the ore; becauſe this metal is fuſible with very little heat, and is very eaſily calcinable. 2. To prevent this calcination of the reduced metal, a larger quantity of charcoal is uſed in this than in moſt other fuſions. 3. The ſcoria muſt be frequently removed, leſt ſome of the tin ſhould be involved in it; and the melted metal muſt be covered with charcoal powder, to prevent the calcination of its ſurface. 4. No flux or other ſubſtance, excepting the ſcoria of former ſmeltings which contains ſome tin, are to be added, to facilitate the fuſion.

Sect. VII. *Smelting of Ores of Lead.*

Ores of lead are either pure, that is, containing no mixture of other metal; or they are mixed with ſilver, copper, or pyrites. The methods of treating ores of lead containing ſilver and copper, are deſcribed in the ſections of *Smelting of Ores of Silver* and *of Copper;* and in the former of theſe an inſtance is given of the method of ſmelting the ore of Ramelſberg, which contains all theſe three metals.

Pure ores of lead, and thoſe which contain ſo ſmall a quantity only of ſilver as not to compenſate for the expence of extracting the nobler metal, may be ſmelted in furnaces, and by operations ſimilar to thoſe uſed at Ramelſberg, or in the following methods. 1. From the lead-ore of Willach in Carinthia, a great part of the lead is obtained by a kind of eliquation, during the roaſting of the ore. For this purpoſe, the ore is thrown upon ſeveral ſtrata or layers of wood, placed in a calcining or reverberatory furnace. By kindling this wood, a great part of the lead flows out of the ore, through the layers of fuel, into a baſon placed for its reception. The ore which is thus roaſted is beat into ſmaller pieces, and expoſed to a ſecond operation ſimilar to the former, by which more metal is eliquated; and the remaining ore is afterwards ground, waſhed, and ſmelted, in the ordinary method.

The lead of Willach is the pureſt of any known, Schlutter aſcribes its great purity to the method uſed in extracting it, by which the moſt fuſible, and conſequently the pureſt part of the contained lead, is ſeparated from any leſs fuſible metal which happens to be mixed with it, and which remains in the roaſted ore. This method requires a very large quantity of wood.

2. In England, lead ores are ſmelted either upon a hearth, or in a reverberatory furnace called *a cupel.*

In the firſt of theſe methods, charcoal is employed as fuel, and the fire is excited by bellows. Small quantities of fuel and of ore are thrown alternately and frequently upon the hearth. The fuſion is very quickly effected: and the lead flows from the hearth as faſt as it is ſeparated from the ore.

Smelting of Ores of Semi-metals.

3. In the ſecond method practiſed in England, pit-coal is uſed as fuel. The ore is melted by means of the flame paſſing over its ſurface; its ſulphur is burnt and diſſipated, while the metal is ſeparated from the ſcoria, and collected at the bottom of the furnace. When the ore is well cleanſed and pure, no addition is requiſite; but when it is mixed with calcareous or earthy matrix, a kind of fluor or fuſible ſpar found in the mines is generally added to render the ſcoria more fluid, and thereby to aſſiſt the precipitation of the metal. When the fuſion has been continued about eight hours, a paſſage in the ſide of the furnace is opened, through which the liquid lead flows into an iron ciſtern. But immediately before the lead is allowed to flow out of the furnace, the workmen throw upon the liquid maſs a quantity of ſlacked quicklime, which renders the ſcoria ſo thick and tenacious. that it may be drawn out of the furnace by rakes. Schlutter mentions this addition of quicklime in the ſmelting of lead ores in England, but thinks that it is intended to facilitate the fuſion of the ores; whereas it really has a contrary effect, and is never added till near the end of the operation, when the ſcoria is to be raked from the furnace of the metal.

Sect. VIII. *Of the Smelting of Ores of Semi-metals.*

Antimony is obtained by a kind of eliquation from the minerals containing it, as is deſcribed in the article Antimony; and the regulus of antimony is procured from antimony, by the proceſſes deſcribed in the ſame article, and in the article *Regulus of Antimony.*

Arſenic, *ſaffre*, and *biſmuth*, are obtained generally from one ore, namely, that called *cobalt.* The arſenic of the ore is ſeparated by roaſting, and adheres to the internal ſurface of a chimney, which is extended horizontally about 200 or 300 feet in length, and in the ſides of which are ſeveral doors, by means of which the arſenic, when the operation is finiſhed, may be ſwept out and collected. Theſe chimneys are generally bent in a zig-zag direction, that they may better retard and ſtop the arſenical flowers. Theſe flowers are of various colours, white, grey, red, yellow, according to the quantity of ſulphur or other impurity with which they happen to be mixed. They are afterwards purified by repeated ſublimations; while ſome alkaline or other ſubſtances are added to detain the ſulphur, and to aſſiſt the purification.

In the ſame roaſting of the ore by which the arſenic is expelled, the biſmuth, or at leaſt the greateſt part of this ſemimetal which is contained in the ore, being very fuſible, and having no diſpoſition to unite with the regulus of cobalt, which remains in the ore, is ſeparated by eliquation.

The remaining part of the roaſted ore conſiſts chiefly of calx of regulus of cobalt, which not being volatile, as the arſenic is, nor ſo eaſily fuſible as biſmuth is, has been neither volatilized nor melted. It contains alſo ſome biſmuth, and a ſmall quantity of arſenic, together

Smelting of Ores of Semi-metals.

gether with any silver or other fixed metal which happened to be contained in the ore. This roasted ore being reduced to a fine powder, and mixed with three or four times its weight of fine sand, is the powder called *saffre* or *zaffre*. Or the roasted ore is sometimes fused with about thrice its quantity of pure sand and as much pure pot-ash, by which a blue glass, called *smalt*, is produced; and a metallic mass, called *speiss*, is collected at the bottom of the vessel in which the matters are fused. The metallic mass or speiss is composed of very different substances, according to the contents of the ore and the methods of treating it. The matters which it contains at different times are, nickel, regulus of cobalt, bismuth, arsenic, sulphur, copper, and silver.

See Zaffre.

See Smalt.

Bismuth is seldom procured from any other ores but that of cobalt. It might, however be extracted from its proper ores, if a sufficient quantity of these were found, by the same method by which it is obtained from cobalt, namely, by eliquation.

Mercury, when native, and inveloped in much earthy or other matter, from which it cannot be separated merely by washing, is distilled either by ascent or by descent. When it is mineralised by sulphur, that is when it is contained in cinnabar, some intermediate substance, as quicklime or iron, must be added in the distillation, to disengage it from the sulphur.

The rich ore of Almaden in Spain is a cinnabar, with which a calcareous stone happens to be so blended, that no addition is required to disengage the mercury from the sulphur. The distillation is there performed in a furnace consisting of two cavities, one of which is placed above another. The lower cavity is the fire-place, and contains the fuel, resting upon a grate, through the bars of which the air enters, maintains the fire and passes into a chimney, placed at one side of the fire-place immediately above the door thro' which fuel is to be introduced. The roof of this fire-place, which is vaulted and pierced with several holes, is also the floor of the upper cavity. Into this upper cavity, the mineral from which mercury is to be distilled is introduced, through a door in one of the sides of the furnace. In the opposite wall of this cavity are eight openings, all at the same height. To each of these openings is adapted a file of aludels connected and luted together, extending 60 feet in length. These aludels, which are earthen vessels open at each end, and wider in the middle than at either extremity, are supported upon an inclined terras; and the aludel of each file, that is most distant from the furnace, terminates in a chamber built of bricks, which has two doors and two chimneys.

When the upper cavity is filled sufficiently with the mineral, a fire is made below, which is continued during 12 or 14 hours. The heat is communicated thro' the holes of the vaulted roof of the fire-place to the mineral in the upper cavity, by which means the mercury is volatilised, and its vapour passes into the aludels, where much of it is condensed and the rest is discharged into the brick chamber, in which it circulates till it also is condensed. If any air or smoke passes through the aludels along with the vapour of the mercury, they escape through the two chimneys of the chamber. Three days after the operation, when the apparatus is sufficiently cooled, the aludels are unluted, the doors of the chamber are opened, and the mercury is collected.

Metamorphosis, Metaphor.

METAMORPHOSIS, in general, denotes the changing of something into a different form; in which sense it includes the transformation of insects, as well as the mythological changes related by the ancient poets.

Mythological metamorphoses were held to be of two kinds, apparent and real: thus, that of Jupiter into a bull, was only apparent; whereas that of Lycaon into a wolf, was supposed to be real.

Most of the ancient metamorphoses include some allegorical meaning, relating either to physics or morality: some authors are even of opinion that a great part of the ancient philosophy is couched under them; and Lord Bacon and Dr Hook have attempted to unriddle several of them.

METAPHOR, in rhetoric. See ORATORY, n° 50.

METAPHOR *and Allegory*, in poetry.—A metaphor differs from a simile, in form only, not in substance: in a simile the two subjects are kept distinct in the expression, as well as in the thought; in a metaphor, the two subjects are kept distinct in the thought only, not in the expression. A hero resembles a lion, and upon that resemblance many similies have been raised by Homer and other poets. But instead of resembling a lion, let us take the aid of the imagination, and feign or figure the hero to be a lion, by that variation the simile is converted into a metaphor; which is carried on by describing all the qualities of a lion that resemble those of the hero. The fundamental pleasure here, that of resemblance, belongs to the thought. An additional pleasure arises from the expression: the poet, by figuring his hero to be a lion, goes on to describe the lion in appearance, but in reality the hero; and his description is peculiarly beautiful, by expressing the virtues and qualities of the hero in new terms, which, properly speaking, belong not to him, but to the lion. This will better be understood by examples. A family connected with a common parent, resembles a tree, the trunk and branches of which are connected with a common root: but let us suppose, that a family is figured, not barely to be like a tree, but to be a tree; and then the simile will be converted into a metaphor, in the following manner:

Edward's sev'n sons, whereof thyself art one,
Were sev'n fair branches springing from one root;
Some of these branches by the dest'nies cut:
But Thomas, my dear lord, my life, my Glo'ster,
One flourishing branch of his most royal root,
Is hack'd down, and his summer-leaves all faded,
By Envy's hand and Murder's bloody axe.

Richard II. *act* i. *sc.* 2.

Figuring human life to be a voyage at sea:

There is a tide in the affairs of men,
Which, taken at the flood, leads on to Fortune:

Metaphor.

Omitted, all the voyage of their life
Is bound in ſhallows and in miſeries.
On ſuch a full ſea are we now afloat;
And we muſt take the current when it ſerves,
Or loſe our ventures. *Julius Cæſar, act* iv. *ſc.* 5.

Figuring glory and honour to be a garland of flowers:

Hotſpur.——————Wou'd to heav'n,
Thy name in arms were now as great as mine!
Pr. Henry. I'll make it greater ere I part from thee;
And all the budding honours on thy creſt
I'll crop, to make a garland for my head.
Firſt part of Henry IV. *act* v. *ſc.* 9.

Figuring a man who hath acquired great reputation and honour to be a tree full of fruit:

——————Oh, boys, this ſtory
The world may read in me; my body's mark'd
With Roman ſwords; and my report was once
Firſt with the beſt of note. Cymbeline lov'd me;
And when a ſoldier was the theme, my name
Was not far off; then was I as a tree,
Whoſe boughs did bend with fruit. But in one night,
A ſtorm or robbery, call it what you will,
Shook down my mellow hangings, nay my leaves;
And left me bare to wither.
Cymbeline act iii. *ſc.* 3.

"Bleſt be thy ſoul, thou king of ſhells, ſaid Swaran of the dark-brown ſhield. In peace, thou art the gale of ſpring; in war, the mountain-ſtorm. Take now my hand in friendſhip, noble king of Morven.
Fingal.

"Thou dwelleſt in the ſoul of Malvina, ſon of mighty Oſſian. My ſighs ariſe with the beam of the eaſt: my tears deſcend with the drops of night. I was a lovely tree in thy preſence, Oſcar, with all my branches round me: but thy death came like a blaſt from the deſart, and laid my green head low, the ſpring returned with its ſhowers, but no leaf of mine aroſe."
Fingal.

An *allegory* differs from a metaphor; and a *figure of ſpeech* differs from both. A metaphor is defined above to be an act of the imagination, figuring one thing to be another. An allegory requires no ſuch operation, nor is one thing figured to be another: it conſiſts in choofing a ſubject having properties or circumſtances reſembling thoſe of the principal ſubject: and the former is deſcribed in ſuch a manner as to repreſent the latter: the ſubject thus repreſented is kept out of view: we are left to diſcover it by reflection; and we are pleaſed with the diſcovery, becauſe it is our own work. (See the word ALLEGORY.) Quintilian gives the following inſtance of an allegory,

O navis, referent in mare te novi
Fluctus. O quid agis? fortiter occupa portum.
Horat. lib. i. *ode* 14.

and explains it elegantly in the following words: "Totuſque ille Horatii locus, quo navim pro republica, fluctuum tempeſtates pro bellis civilibus, portum pro pace atque concordia, dicit."

In a *figure of ſpeech*, there is no fiction of the imagination employed, as in a metaphor; nor a repreſentative ſubject introduced, as in an allegory. This figure, as its name implies, regards the expreſſion only, not the thought; and it may be defined, the uſing a word in a ſenſe different from what is proper to it.— Thus youth, or the beginning of life, is expreſſed figuratively by *morning of life*: morning is the beginning of the day; and in that view it is employed to ſignify the beginning of any other ſeries, life eſpecially, the progreſs of which is reckoned by days. See *FIGURE of Speech.*

Metaphor and *allegory* are ſo much connected, that it ſeemed proper to handle them together: the rules particularly for diſtinguiſhing the good from the bad, are common to both. We ſhall therefore proceed to theſe rules, after adding ſome examples to illuſtrate the nature of an *allegory*, which, with a view to this article, was but ſlightly illuſtrated under its proper name.

Horace, ſpeaking of his love to Pyrrha, which was now extinguiſhed, expreſſeth himſelf thus:

——————Me tabula ſacer
Votivâ paries indicat uvida
Suſpendiſſe potenti
Veſtimenta maris Deo. *Carm. lib.* i. *ode* 5.

Again:

Phœbus volentem prælia me loqui,
Victas et urbes, increpuit, lyrâ
Ne parva Tyrrhenum per æquor
Vela darem. *Carm. lib.* iv. *ode* 15.

Queen. Great Lords, wiſe men ne'er ſit and wail their loſs,
But cheerly ſeek how to redreſs their harms.
What though the maſt be now blown overboard,
The cable broke, the holding-anchor loſt,
And half our ſailors ſwallowed in the flood!
Yet lives our pilot ſtill. Is't meet that he
Should leave the helm, and like a fearful lad,
With tearful eyes add water to the ſea,
And give more ſtrength to that which hath too much;
While in his moan the ſhip ſplits on the rock,
Which induſtry and courage might have ſav'd?
Ah, what a ſhame! ah, what a fault were this!
Third part of Henry VI. *act.* v. *ſc.* 5.

Oroonoko. Ha! thou haſt rous'd
The lion in his den; he ſtalks abroad,
And the wide foreſt trembles at his roar.
I find the danger now. *Oroonoko, act* iii. *ſc.* 2.

"My well-beloved hath a vineyard in a very fruitful hill. He fenced it, gathered out the ſtones thereof, planted it with the choiceſt vine, built a tower in the midſt of it, and alſo made a wine-preſs therein; he looked that it ſhould bring forth grapes, and it brought forth wild grapes. And now, O inhabitants of Jeruſalem, and men of Judah, judge, I pray you, betwixt me and my vineyard. What could have been done more to my vineyard, that I have not done? Wherefore when I looked that it ſhould bring forth grapes, brought it forth wild grapes. And now go to, I will tell you what I will do to my vineyard: I will take away the hedge thereof, and it ſhall be eaten up; and break down the wall thereof, and it ſhall be trodden down. And I will lay it waſte: it ſhall not be pruned, nor digged, but there ſhall come up briars and thorns: I will alſo command the clouds that they rain no rain upon it. For the vineyard of the Lord of hoſts is the houſe of Iſrael and the men of Judah his pleaſant plant." *Iſaiah.* v. 1.

The

Metaphor.

The rules that govern metaphors and allegories are of two kinds. The construction of these figures comes under the first kind: the propriety or impropriety of introduction comes under the other.—To begin with rules of the first kind; some of which coincide with those already given for similes; some are peculiar to metaphors and allegories.

In the first place, it has been observed, that a simile cannot be agreeable where the resemblance is either too strong or too faint. This holds equally in metaphor and allegory; and the reason is the same in all. In the following instances, the resemblance is too faint to be agreeable.

Malcolm.——But there's no bottom, none,
In my voluptuousness: your wives, your daughters,
Your matrons, and your maids, could not fill up
The cistern of my lust. *Macbeth, act* iv. *sc.* 4.

The best way to judge of this metaphor, is to convert it into a simile: which would be bad, because there is scarce any resemblance between lust and a cistern, or betwixt enormous lust and a large cistern.

Again:

He cannot buckle his distemper'd cause
Within the belt of rule. *Macbeth, Act* iv. *sc.* 2,

There is no resemblence between a distempered cause and any body that can be confined within a belt.

Again:

Steep me in poverty to the very lips.
Othello, Act iv. *sc.* 9.

Poverty here must be conceived a fluid, which it resembles not in any manner.

Speaking to Bolingbroke banish'd for six years:

The sullen passage of thy weary steps
Esteem a soil, wherein thou art to set
The precious jewel of thy home-return.
Richard II. *Act* ii. *sc.* 6.

Again:

Here is a letter, lady,
And every word in it a gaping wound
Issuing life-blood.
Merchant of Venice, Act iii. *sc.* 3.

Tantæ *molis* erat Romanam condere gentem.
Æneid. i. 37.

The following metaphor is strained beyond all endurance: Timur-bec, known to us by the name of *Tamerlane the Great*, writes to Bajazet emperor of the Ottomans in the following terms:

"Where is the monarch who dares resist us? where is the potentate who doth not glory in being numbered among our attendants? As for thee, descended from a Turcoman sailor, since the vessel of thy unbounded ambition hath been wreck'd in the gulf of thy self-love it would be proper, that thou shouldst take in the sails of thy temerity, and cast the anchor of repentance in the port of sincerity and justice, which is the port of safety; lest the tempest of our vengeance make thee perish in the sea of the punishment thou deserveſt."

Such strained figures, as observed above, are not unfrequent in the first dawn of refinement; the mind in a new enjoyment knows no bounds, and is generally carried to excess, till taste and experience discover the proper limits.

Secondly, whatever resemblance subjects may have, it is wrong to put one for another, where they bear no mutual proportion. Upon comparing a very high to a very low subject, the simile takes on an air of burlesque; and the same will be the effect where the one is imagined to be the other, as in a metaphor; or made to represent the other, as in an allegory.

Thirdly, These figures, a metaphor especially, ought not to be crowded with many minute circumstances; for in that case it is scarcely possible to avoid obscurity. A metaphor above all ought to be short: it is difficult, for any time, to support a lively image of a thing being what we know it is not; and for that reason, a metaphor drawn out to any length, instead of illustrating or enlivening the principal subject, becomes disagreeable by overstraining the mind. Here Cowley is extremely licentious: take the following instance.

Great and wise conqu'ror, who, where-e'er
Thou com'st, dost fortify, and settle there!
Who canst defend as well as get;
And never hadst one quarter beat up yet;
Now thou art in, thou ne'er will part
With one inch of my vanquish'd heart;
For since thou took'st it by assault from me,
'Tis garrison'd so strong with thoughts of thee,
It fears no beauteous enemy.

For the same reason, however agreeable long allegories may at first be by their novelty, they never afford any lasting pleasure: witness the *Fairy Queen*, which with great power of expression, variety of images, and melody of versification, is scarce ever read a second time.

In the fourth place, the comparison carried on in a simile, being in a metaphor sunk by imagining the principal subject to be that very thing which it only resembles; an opportunity is furnished to describe it in terms taken strictly or literally with respect to its imagined nature. This suggests another rule. That in constructing a metaphor, the writer ought to make use of such words only as are applicable literally to the imagined nature of his subject: figurative words ought carefully to be avoided; for such complicated figures, instead of setting the principal subject in a strong light, involve it in a cloud, and it is well if the reader, without rejecting by the lump, endeavour patiently to gather the plain meaning, regardless of the figures:

A stubborn and unconquerable flame
Creeps in his veins, and drinks the streams of life.
Lady Jane Gray, Act i. *sc.* 1.

Copied from Ovid,

Sorbent avidæ præcordia flammæ.
Metamorph. lib. ix. 172.

Let us analyse this expression. That a fever may be imagined a flame, we admit: though more than one step is necessary to come at the resemblance: a fever, by heating the body, resembles fire; and it is no stretch to imagine a fever to be a fire: again, by a figure of speech,

Metaphor. speech, flame may be put for fire, because they are commonly conjoined; and therefore a fever may be termed a *flame*. But now admitting a fever to be a flame, its effects ought to be explained in words that agree literally to a flame. This rule is not observed here; for a flame drinks figuratively only, not properly.

King Henry to his son prince Henry:
Thou hid'st a thousand daggers in thy thoughts,
Which thou hast whetted on thy stony heart
To stab at half an hour of my frail life.
Second part Henry IV. *act* iv. *sc.* 11.

Such faulty metaphors are pleasantly ridiculed in the *Rehearsal*:

"*Physician.* Sir, to conclude, the place you fill has more than amply exacted the talents of a wary pilot; and all these threatning storms, which, like impregnate clouds, hover o'er our heads, will, when they once are grasp'd but by the eye of reason, melt into fruitful showers of blessings on the people.

"*Bayes.* Pray mark that allegory. Is not that good?

"*Johnson.* Yes, that grasping of a storm with the eye is admirable." *Act* ii. *sc.* 1.

Fifthly, the jumbling different metaphors in the same sentence, beginning with one metaphor and ending with another, commonly called a *mixt metaphor* ought never to be indulged.

K. Henry.——Will you again unknit
This churlish knot of all abhorred war,
And move in that obedient orb again,
Where you did give a fair and natural light?
First part Henry VI. *Act* v. *sc.* 1.

Whether 'tis nobler in the mind, to suffer
The stings and arrows of outragious fortune;
Or to take arms against a sea of troubles,
And by opposing end them.
Hamlet, Act iii. *sc.* 2.

In the sixth place, It is unpleasant to join different metaphors in the same period, even where they are preserved distinct; for when the subject is imagined to be first one thing and then another in the same period without interval, the mind is distracted by the rapid transition; and when the imagination is put on such hard duty, its images are too faint to produce any good effect:

At regina gravi jamdudum saucia cura,
Vulnus alit venis, et cæco carpitur igni,
Æneid. iv. 1.

——————— Est mollis flamma medullas
Interea, et tacitum vivit sub pectore vulnus.
Æneid. iv. 66.

Motum ex Metello consule civicum,
Bellique causas, et vitia, et modos,
Ludumque fortunæ, gravesque
Principum amicitias, et arma
Nondum expiatis uncta cruoribus,
Periculosæ plenum opus aleæ,
Tractas, et in incedis per ignes
Subpositos cineri doloso.
Horat, Carm. lib. ii. *ode* 1.

In the last place, It is still worse to jumble together metaphorical and natural expression, so as that the period must be understood in part metaphorically; in part literally; for the imagination cannot follow with sufficient ease changes so sudden and unprepared: a metaphor begun and not carried on, hath no beauty; and instead of light, there is nothing but obscurity and confusion. Instances of such incorrect composition are without number: we shall, for a specimen, select a few from different authors Speaking of Britain.

This precious stone set in the sea,
Which serves it in the office of a wall,
Or as a moat defensive to a house
Against the envy of less happier lands.
Richard II. *act* ii. *sc.* 1.

In the first line Britain is figured to be a precious stone: in the following line, Britain, divested of her metaphorical dress, is presented to the reader in her natural appearance.

These growing feathers pluck'd from Cæsar's wing,
Will make him fly an ordinary pitch.
Who else would soar above the view of men,
An eep us all in servile fearfulness.
Julius Cæsar, act i. *sc.* 1.

Rebus angustis animosus atque
Fortis appare: sapienter idem
Contrahes vento nimium secu
Turgida vela. *Hor.*

The following is a miserable jumble of expressions, arising from an unsteady view of the subject, between its figurative and natural appearance:

But now from gath'ring clouds destruction pours,
Which ruins with mad rage our halcyon hours;
Mists from black jealousies the tempest form,
Whilst late divisions reinforce the storm.
Dispensary, canto iii.

To thee the world its pleasant homage pays,
The harvest early, but mature the praise.
Pope's imitation of Horace, B. ii.

Oui, sa pudeur ne'st que franche grimace,
Qu'une ombre de vertu qui garde mal la place,
Et qui s'evanouit, comme l'on peut savoir,
Aux rayons du soleil qu'une bourse vait voir.
Moliere, L'Etourdi, Act iii. *sc.* 2.

Et son feu, de pourvû de sense et de lecture,
S'eteint à chaque pas, faut de nourriture,
Boileau, L'art poetique, chant. iii. l. 319.

Dryden, in his dedication of the translation of *Juvenal*, says, "When thus, as I may say, before the use of the loadstone, or knowledge of the compass, I was sailing in a vast ocean, without other help than the pole-star of the ancients, and the rules of the French stage among the moderns, &c."

"There is a time when factions, by the vehemence of their own fermentation, stun and disable one another." *Bolingbroke.*

This fault of jumbling the figure and plain expression into one confused mass, is not less common in allegory than in metaphor.

Take

Metaphor. Take the following examples:

——————Heu! quoties fidem,
Mutatosque Deos flebit, et aspera
Nigris æquora ventis
Emirabitur insolens,
Qui nunc te fruitur credulus aureâ:
Qui semper vacuam, semper amabilem
Sperat, nescius auræ
Fallacis. *Horat. Carm. lib.* i. *ode* 5.

Pour moi sur cette mer, qu'ici bas nous courons,
Je songe à pourvoir d'esquif et d'avirons,
A regler mes desires, à prévenir l'orage,
Et sauver, s'il se peut, ma Raison du naufrage.
Boileau, epitre 5.

Lord Halifax, speaking of the ancient fabulists: "They (says he) wrote in signs, and spoke in parables: all their fables carry a double meaning: the story is one, and entire; the characters the same throughout; not broken or changed, and always conformable to the nature of the creature they introduce. They never tell you, that the dog which snapped at a shadow, lost his troop of horse; that would be unintelligible. This is his (Dryden's) new way of telling a story, and confounding the moral and the fable together." After instancing from the hind and panther, he goes on thus: "What relation has the hind to our Saviour? or what notion have we of a panther's Bible? If you say he means the church, how does the church feed on lawns, or range in the forest? Let it be always a church, or always a cloven-footed beast; for we cannot bear his shifting the scene every line."

A few words more upon allegory. Nothing gives greater pleasure than this figure, when the representative subject bears a strong analogy, in all its circumstances, to that which is represented: but the choice is seldom so lucky; the analogy being generally so faint and obscure, as to puzzle and not please. An allegory is still more difficult in painting than in poetry: the former can show no resemblance but what appears to the eye; the latter hath many other resources for showing the resemblance. And therefore, with respect to what the Abbé du Bos terms *mixt allegorical compositions*, these may do in poetry; because, in writing, the allegory can easily be distinguished from the historical part: no person, for example, mistakes Virgil's Fame for a real being. But such a mixture in a picture is intolerable; because in a picture the objects must appear all of the same kind, wholly real or wholly emblematical. For this reason, the history of Mary de Medicis, in the palace of Luxembourg, painted by Rubens, is unpleasant by a perpetual jumble of real and allegorical personages, which produce a discordance of parts, and an obscurity upon the whole: witness, in particular, the tablature representing the arrival of Mary de Medicis at Marseilles; where, together with the real personages, the Nereides and Tritons appear sounding their shells: such a mixture of fiction and reality in the same group, is strangely absurd. The picture of Alexander and Roxana, described by Lucian, is gay and fanciful; but it suffers by the allegorical figures. It is not in the wit of man to invent an allegorical representation deviating farther from any shadow of resemblance, than one exhibited by Louis XIV. anno 1664; in which an enormous chariot, intended to represent that of the sun, is dragged along, surrounded with men and women, representing the four ages of the world, the celestial signs, the seasons, the hours, &c. a monstrous composition and yet scarce more absurd than Guido's tablature of Aurora.

In an allegory, as well as in a metaphor, terms ought to be chosen that properly and literally are applicable to the representative subject: nor ought any circumstance to be added that is not proper to the representative subject, however justly it may be applicable properly or figuratively to the principal. The following allegory is therefore faulty:

Ferus et Cupido,
Semper ardentes acuens sagittas
Cote *cruentâ* *Horat. lib.* ii. *ode* 8.

For though blood may suggest the cruelty of love, it is an improper or immaterial circumstance in the representative subject: water, not blood, is proper for a whetstone.

We proceed to the next head, which is, to examine in what circumstances these figures are proper, in what improper. This inquiry is not altogether superseded by what is said upon the same subject in the article COMPARISON; because upon trial, it will be found that a short metaphor or allegory may be proper, where a simile, drawn out to a greater length, and in its nature more solemn, would scarce be relished.

And, in the first place, a metaphor, like a simile, is excluded from common conversation, and from the description of ordinary incidents. Secondly, in expressing any severe passion that totally occupies the mind, metaphor is unnatural.

The following example, of deep despair, beside the highly figurative style, has more the air of raving than of sense:

Calista. Is it the voice of thunder, or my father?
Madness? confusion! let the storm come on,
Let the tumultuous roar drive all upon me,
Dash my devoted bark; ye surges, break it;
'Tis for my ruin that the tempest rises.
When I am lost, sunk to the bottom low,
Peace shall return, and all be calm again.
Fair Penitent, act 5.

The following metaphor is sweet and lively; but it suits not the fiery temper of Chamont, inflamed with passion: parables are not the language of wrath venting itself without restraint:

Chamont. You took her up a little tender flow'r,
Just sprouted on a bank, which the next frost
Had nipp'd; and with a careful loving hand,
Transplanted her into your own fair garden,
Where the sun always shines: there long she flourish'd,
Grew sweet to sense, and lovely to the eye;
Till at the last a cruel spoiler came,
Cropt this fair rose, and rifled all its sweetness,
Then cast it like a loathsome weed away. *Orph. act* 4.

The following speech, full of imagery, is not natural in grief and dejection of mind.

Gonsalez. O my son! from the blind dotage
Of a father's fondness these ills arose.
For thee I've been ambitious, base, and bloody:

Metaphor. For thee I've plung'd into this sea of sin;
Stemming the tide with only one weak hand,
While t'other bore the crown (to wreathe thy brow),
Whose weight has sunk me ere I reach'd the shore.
Mourning Bride, act 5. *sc.* 6.

There is an enchanting picture of deep distress in Macbeth, where Macduff is represented lamenting his wife and children, inhumanly murdered by the tyrant. Stung to the heart with the news, he questions the messenger over and over: not that he doubted the fact, but that his heart revolted against so cruel a misfortune. After strugling some time with his grief, he turns from his wife and children to their savage butcher; and then gives vent to his resentment, but still with manliness and dignity:

O, I could play the woman with mine eyes,
And braggart with my tongue. But, gentle Heav'n!
Cut short all intermission; front to front
Bring thou this fiend of Scotland and myself;
Within my sword's length set him.—If he 'scape,
Then Heav'n forgive him too.

Metaphorical expression, indeed, may sometimes be used with grace where a regular simile would be intolerable: but there are situations so severe and dispiriting, as not to admit even the slightest metaphor. It requires great delicacy of taste to determine with firmness, whether the present case be of that nature: perhaps it is; yet who could wish a single word of this admirable scene altered? Metaphor.

But metaphorical language is proper when a man struggles to bear with dignity or decency a misfortune however great; the struggle agitates and animates the mind:

Wolsey. Farewell, a long farewell, to all my greatness!
This is the state of man: to day he puts forth
The tender leaves of hope; to-morrow blossoms,
And bears his blushing honours thick upon him;
The third day comes a frost, a killing frost,
And when he thinks, good easy man, full surely
His greatness is a ripening, nips his root,
And then he falls as I do. *Henry* VIII. *act.* 3. *sc.* 6.

METAPHRAST, a translator, or person who renders an author into another form or another language, word for word.

METAPHYSICS.

1 Definition. METAPHYSICS has been defined, by a writer deeply read in the ancient philosophy, "The science of the principles and causes of all things existing." This definition, we think, extremely proper: and hence it is, that *mind* or intelligence, and especially the *supreme intelligence*, which is the cause of the universe and of every thing which it contains, is the principal subject of this science; and hence, too, the science itself received its name. Aristotle, indeed, who of all the ancient metaphysicians whose works have come down to us, was unquestionably the greatest, calls this science THE FIRST PHILOSOPHY, as being not only superior, but also prior in the order of nature, to the whole circle of the other arts and sciences. But, "what is first to nature, is not first to man." Nature begins with *causes* which produce *effects*. Man begins with *effects*, and by them ascends to *causes*. Thus all human study and investigation proceed of necessity in the reverse of the natural order of things, from *sensible* to *intelligible*, from *body* the effect, to *mind*, which is both the first and the final cause. Now, PHYSICS being the name given by the Stagyrite to the philosophy of body, some of his interpreters, from this necessary course of human studies, called that of mind METAPHYSICS, implying by that term, not only that its subject is more sublime and difficult, but also that the study of it would be most properly and successfully entered upon AFTER THAT OF PHYSICS. To this name, which, though it has sometimes been treated with ridicule, is abundantly significant, the followers of Aristotle were led by their master, who, to the books in which he pretends to elevate the mind above things corporeal to the contemplation of God and things spiritual, prefixed the Greeks words μετα τα φυσικα (A).

2 Division of the Science into The science of Metaphysics has been divided, according to the objects which it considers, into six principal parts which are called. 1. *Ontology*; 2. *Cosmology*; 3. *Anthroposophy*; 4. *Psychology*; 5. *Pneumatology*; and, 6. *Metaphysical theology*.

3 Ontology; 1. That part of the science which is named *ontology*, investigates and explains the nature and essence of all beings, as well as qualities the and attributes that essentially appertain to them. Hence it has been said that ontology should proceed in its operations from the most simple ideas; such as do not admit of any other qualities of which they may be compounded. These simple ideas are of *being*, of *essence*, of *substance*, of *mode*, of *existence* as well with regard to time as place, of a *necessary cause* of *unity*; the idea of *negation*; the difference between a *being* that is *simple* or *compound*, *necessary* or *accidental*, *finite* or *infinite*; the ideas of *essential* and *abstract properties*, such as of the *greatness*, *perfection*, and *goodness* of *beings*, &c. The business therefore of ontology, is to make us acquainted with every kind of being in its nature and essential qualities, which distinguish it from all other beings. This knowledge being once established on simple principles, just consequences may thence be drawn, and those things proved after which the metaphysician enquires,

(A) ΤΩΝ ΜΕΤΑ ΤΑ ΦΥΣΙΚΑ. Cujus inscriptionis hæc ratio est, quod in hoc opera ea tractantur quorum theoria posterior est doctrina naturali saltem quoad nos, qui a corporum cognitione rerumque caducarum in substantiarum immaterialium atque immortalium contemplationem provehimur.
Du Val. Synopf. Doctr. Peripat.

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quires, and which is the business of his science to prove.

It is easy to conceive, that even a clear knowledge of beings, and their essential properties, would be still defective and useless to man, if he did not know how to determine and fix his ideas by proper denominations, and consequently to communicate his perceptions to those whom he would instruct, or against whom he is obliged to dispute. To render our ideas therefore intelligible to others, we must have determinate words or denominations for each being, and the qualities of each being; and ontology teaches us those terms which are so necessary to fix our ideas, and to give them the requisite perspicuity and precision, that when we endeavour to extend the sphere of our knowledge, we may not waste our time in disputes about words.

4 Cosmology;

2. Metaphysics, having, in as solid a manner as possible, explained and established the principles above mentioned, continues its enquiries to the second part, which is called *cosmology*, and examines into the essence of the world and all that it contains, its eternal laws; of the nature of matter; of motion; of the nature of tangible bodies, their attributes and adjuncts; and of all that can be known by reasoning and experience. It is also in cosmology that the metaphysicians of this school examine the Leibnitzian system; that is, whether God, in creating the world, must necessarily have created the best world; and if this world be so in fact. In this manner they pursue the argument, from consequence to consequence, to its last resort, frequently with very little advantage to truth and science.

5 Anthroposophy;

3. *Anthroposophy*, or the knowledge of man, forms the third branch of metaphysics. It is subdivided into two parts. The first, which consists in the knowledge of the exterior parts of the human frame, belongs not to this science, but to Anatomy and Physiology. The business of the metaphysician is here to ascertain the nature of those powers by which all the motions essential to life are produced; and to discover, if possible, whether they be corporeal or spiritual. This inquiry leads at the same time to

6 Psychology

4. *Psychology;* which consists in the knowledge of the intellectual soul in particular; concerning which, the most profound, the most subtile, and most abstract researches, have been made that human reason is capable of; and concerning the substance of which, in spite of all these efforts, it is yet extremely difficult to support any positive opinion with conclusive or probable arguments.

7 Pneumatology;

5. The fifth part of metaphysics is called *pneumatology*. By this term, which has not been long in use, metaphysicians mean the knowledge of all spirits, *angels*, &c. It is easy to conceive what infinite art is necessary to give an account of that, of which nothing positive can ever be known in the present state of human existence. But the metaphysician of this school readily offers to show us, "what is the idea of a spirit; the effective existence of a spirit; what are its general qualities and properties; that there are rational spirits, and that these rational spirits have qualities that are founded in the moral attributes of God:" for this is in so many words what is attempted to be taught in pneumatology.

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8 Metaphysical theology.

6. *Metaphysical theology*, which Leibnitz and some others call *theodicy*, is the sixth and last branch of the science of metaphysics. It teaches us the knowledge of the existence of God; to make the most rational suppositions concerning his divine essence, and to form a just idea of his attributes and perfections, and to demonstrate them by abstract reasoning. Theodicy differs from natural theology, in as much as this last borrows, in fact, from theodicy proofs and demonstrations to confirm the existence of a supreme Being: but after having solidly established that great truth, by extending its consequences natural theology teaches us what are the relations and connections that subsist between the supreme Being and men, and what are the duties which result from those relations.

9 This division useless and improper.

We have briefly mentioned these divisions of the science, because they were once prevalent in the schools. The greater part of them, however, appears to us to be not only superfluous, but such as can serve no other purpose than to perplex the mind. The only beings of which we know any thing are mind and body; and we have no reason to think that there are any other beings in the universe. Of bodies indeed there are various kinds, endowed with different properties: and it is extremely probable, that of minds endowed with different powers, the variety may be equally great. Our own minds we know to be united in one system with bodies by which they perform all their operations; and we can demonstrate that there is another Mind, which is independent of all body, and is the cause of all things. Between these there may be numberless orders of minds; but their energies are wholly unknown to us, and therefore they can never become the objects of science.

Mind and body therefore, *i. e.* the minds and bodies which we know to exist, together with their powers and properties, essential and accidental, can alone be the subjects of rational inquiry. We may inquire into the essence of mind and the essence of body, and endeavour to ascertain in what respects they differ. We may examine the nature of different bodies, in order to discover whether all bodies, however modified, have not something in common; and we may consider the properties, relations, and adjuncts of bodies, and endeavour to distinguish those which are accidental from such as appear to be so necessary that without them body itself could not exist. Of minds we cannot make the same comparison. In this part of the science we have not sufficient data for an accurate and complete induction: we can only examine the powers of our own mind; and by probable analogy make some estimate of the powers of superior minds, as observation will help us to guess at the powers of those which are placed beneath us in the scale of existence.

If this be so, Cosmology, as distinguished from Ontology, cannot properly be a branch of Metaphysics. For if mind and body, with their several powers, properties, and adjuncts, compose the universe, it is obvious, that when we have ascertained, as well as we are able to ascertain, the essence of mind and the essence of body, together with the powers and properties of each, and have traced them all to the first cause, we have done every thing in the science of the universe, if we may use the expression, which belongs to

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to the province of the metaphysician. The particular laws of motion on the earth and in the planetary system belong to the natural philosopher and astronomer.

In like manner, Anthroposophy, Psychology, and Pneumatology, if they be not words expressive of distinctions where there is no difference, seem to be at least very needlessly disjoined from each other. Of the nature of spirits we can know nothing but from contemplating the powers of our own minds; and the body of man is in the province, not of the metaphysician, but of the anatomist and physiologist. Anthroposophy, psychology, and pneumatology, if they be used to denote our knowledge of all minds except the Supreme, are words of the same import; for of no created minds except our own can we acquire such knowledge as deserves the name of science.

Ontology has sometimes been defined the science of *being in the abstract*; but in the course of our inquiries it will be seen, that *being in the abstract* is a phrase without meaning. Considered as the science of *real beings* and their *properties*, Ontology is a very significant word, of the same import with Metaphysics, comprehending in itself the knowledge of the nature of all things existing. Or if it be thought proper to make a distinction between ontology and theology, the former branch of the science will teach the knowledge of body and created minds, whilst it is the province of the latter to demonstrate the existence and attributes of that mind which is uncreated.

10 Another proposed.

Body and mind therefore, with their properties, adjuncts, and powers, comprehend the whole subject of the science of metaphysics: and as we are earlier acquainted with body than with mind, the natural order of conducting our inquiries seems to be, to begin with the former, and thence proceed to the latter. It is however obvious, that if we would pursue these inquiries with any hopes of success, we must first trace human knowledge from its source, ascertain the nature of truth, and show what kind of evidence on each topic to be treated ought to enforce conviction. In this view of the science, metaphysics appears to be divided into three parts; the first treating *of human understanding*; the second, *of body with its adjuncts*; and the third, *of mind with its powers*.

11 Idea and notion explained.

Previous to the entering upon such inquiries, some philosophers of great merit have lately thought it expedient to explain the terms which they should have occasion to use. Their conduct is judicious and worthy of imitation; for the objects of metaphysics being, for the most part, such as fall not under the cognisance of the senses, are liable to be differently apprehended by different men, if the meanings of the words by which they are expressed be not ascertained with the utmost precision. We intend, however, to use very few words but in the common acceptation; and we therefore hope, that as terms of science are explained under different words in the Dictionary, to which references are made, we have little or no occasion for swelling the article by previous definitions. There are indeed two words which have given rise to much useless disputation, which yet cannot be banished from speculative philosophy, and which it will therefore be proper here to define. The words, to which we allude are *idea* and *notion*. These are very generally considered as synonymous; but we think that much loquacity might have been avoided by assigning to each a determinate signification. We know not any philosopher who made much use of the word *idea* before Plato; but with his mysterious doctrine concerning ideas we have here nothing to do: our present business is to ascertain the precise meaning of the word, which is evidently derived from ειδω to *see*, as the word *notion* is from "nosco, novi, *notum*," and that from γινωσκω, to *know* or *understand*. In the original sense of the two words, therefore, *notion* is more comprehensive than *idea*, because we *know* many things which cannot be *seen*. We have not a doubt, but that at first the word *idea* was employed to denote only those forms of external objects which men contemplate in their imaginations, and which are originally received through the sense of *sight*. Its signification was afterwards extended to the relicts of every sensation, of touch, taste, sound, and smell, as well as of sight; and at last it was confounded with *notion*, which denotes the mental apprehension of whatever may be known. In our use of the word *idea*, except when we quote from others, we shall employ it only to denote that appearance which absent objects of sense make in the memory or imagination (A); and by the word *notion* we shall denote our apprehension or knowledge of spirits, and all such things as, though they be the objects of science, cannot be perceived by the external senses. Having said this, we proceed to our inquiries, beginning with that into human understanding.

PART

(A) In thus restricting the meaning of the word *idea*, we have the honour to agree with the great English Lexicographer.—"He was particularly indignant against the almost universal use of the word *idea* in the sense of *notion* or *opinion*, when it is clear that *idea* can only signify something of which an image may be formed in the mind. We may have an *idea* or *image* of a mountain, a tree, or a building; but we cannot surely have an *idea* or *image* of an *argument* or *proposition*. Yet we hear the sages of the law delivering their *ideas* upon the question under consideration; and the first speakers in parliament entirely coinciding in the *idea*, which has been so ably stated by an honourable member; or representing an *idea* as unconstitutional, and fraught with the most dangerous consequences to a great and free country. This Johnson called *modern cant*." *Boswell's Life of Johnson.*

PART I. OF HUMAN UNDERSTANDING.

Preliminary Observations on the ORIGIN *of our* IDEAS *and* NOTIONS.

12 No innate ideas or notions in the human mind.

THAT the mind of man has no innate ideas or notions, but comes into the world ignorant of every thing, is a truth which since the days of Locke has been very little disputed. In the first book of his Essay on the Human Understanding, that acute philosopher has demonstrated, that the rudiments or first principles of all our knowledge are communicated to us by sensation; and he has compared the mind previous to the operation of external objects upon the senses, to a *tabula rasa* or sheet of white paper. To repeat his arguments would swell the article to no purpose. There is not a man capable of attending to his own ideas, who can entertain a doubt in what manner he received them. Without the sense of sight, we could never have known colours; nor sound without hearing; nor hardness, softness, smoothness, pain, or bodily pleasure, without touch; nor odours, without smell, &c.

Self-evident as these facts are, objections have been started to the inferences drawn from them; and Locke has been accused of advancing principles subversive of all distinction between truth and falsehood, and favourable of course to universal scepticism.—"The first book of his Essay, which with submission (says Dr Beattie*) I think the worst, tends to establish this dangerous doctrine, that the human mind, previous to education and habit, is as susceptible of one impression as of another: a doctrine which, if true, would go near to prove that truth and virtue are no better than human contrivances; or at least that they have nothing permanent in their nature, but may be as changeable as the inclinations and capacities of men; and that there is no such thing as common sense in the world. Surely this is not the doctrine which Mr Locke meant to establish." We are so thoroughly satisfied that it is not, that we cannot help wondering how such inferences could, by a man of learning, genius, and candour, be drawn from any thing which is to be found in the Essay on the Human Understanding.

*Essay on the Nature and Immutability of Truth.

But the Doctor thinks Mr Locke's "simile of the mind to white paper one of the most unlucky allusions that could have been chosen; because the human soul, when it begins to think, is not extended, nor of a white colour, nor incapable of energy, nor wholly unfurnished with ideas, nor as susceptible of one impression or character as of any other:" and it has been observed by another objector †, that "on a sheet of white paper you may write that sugar is bitter; wormwood sweet; fire and frost in every degree pleasing and sufferable; that compassion and gratitude are base; treachery, falsehood, and envy, noble; and that contempt is indifferent to us."

†J. Usher, author of Clio. See a vol. of Fugitive Pieces printed for J. Davies, London, 1774.

13 Objections answered.

All this is true: but we apprehend it is not to the purpose. Mr Locke has no where expressed himself in such a manner as to lead us to suppose that he believed the soul to be extended or coloured; or, when it begins to think, incapable of energy, and wholly unfurnished with ideas: but he certainly did believe, that it begins not to think the first instant of its existence, and that it *acquires* all the ideas of which it is ever possessed. We may undoubtedly write upon a piece of white paper that sugar is bitter, and that wormwood is sweet; but how the capacity of paper to receive the symbols of false propositions should make Mr Locke's comparison improper or dangerous, we cannot comprehend. Mr Usher indeed says, that it is improper on this account, "that no human art or industry is able to make those impressions upon the mind: in respect of them, the mind discovers not a passive capacity, but resists them with the force of fate." Does it indeed? does the mind reject the idea of sugar or of bitterness, of contempt or of indifference? May not any man have the *idea* of sugar and at the same time the *idea* of bitterness, and compare the one with the other in his mind, as well as the word *sugar* may be written beside the word *bitter*, and connected with it on the same piece of paper? In all this we perceive nothing that is impossible or even difficult. The mind cannot indeed be made to feel that sugar has the same taste with woormwood; but who ever thought that it could? Not Mr Locke, we shall be bold to say; nor does his simile give the smallest countenance to such an absurdity. The author of the Essay on the Human Understanding understood his subject too well to imagine that either truth or falshood could be communicated to paper, or that paper is capable of comparing ideas. Paper is capable of receiving nothing but lines or figures; and it passively receives whatever lines or figures we may choose to inscribe on it: yet if a pen be carried over it in a circular direction, the figure impressed will not be a square; just as, to the mind of one eating sugar, the taste communicated is not that of wormwood.

On a piece of paper a circle may be described, and close beside it a square: in like manner an agreeable sensation may be communicated to the mind, and immediately afterwards a sensation that is disagreeable. These two sensations, or the ideas which they leave behind them, may be compared together; and it is certainly true that no art or industry can make them appear similar in the mind: but is it not equally true, that no art or industry can make the circle and the square similar on the paper? The paper is susceptible of any sort of plain figures, and the mind is equally susceptible of any sort of ideas or sensations; but figures dissimilar cannot be made to coincide, neither can discordant ideas be made to agree. Again, one may write upon paper, that "a circle *is* a square," and likewise that a "circle *is not* a square;" and both these propositions may be communicated to the mind by the organs of sight or of hearing. The paper receives the *words* expressive of the false as well as those expressive of the true proposition; and the mind receives the *ideas* and *relations* signified by the one cluster of words as well as those signified by the other: but in the mind the *idea* of a square is *different* from that of a circle, and on the paper the *figure* of a square is *different* from the *figure* of a circle. The great difference between the mind and the paper is, that *the former* is *conscious* of its ideas, and *perceives* their agreement or disagreement; whereas the paper is *not* conscious of the

Origin of Ideas and Notions.

the figures drawn upon it, nor perceives any thing about them. But ſtill thoſe figures are what they are; they either agree or diſagree on the paper, as well as the ideas either agree or diſagree in the mind. It is not in the power of the mind to alter the *ideas* of the ſquare and the circle, nor in the power of the paper to alter the *forms* of theſe figures.

It appears then, that the principles of Mr Locke, and the compariſon by which he illuſtrates them, have no more tendency to ſubvert the difference between truth and falſehood, right and wrong, than the paſſiveneſs of paper has to ſubvert the difference between a ſtraight line and a crooked, a circle and a ſquare: and with a view to eſtabliſh the doctrine of innate ideas and inſtinctive principles of knowledge, we might with as much propriety aſk, Whether it be poſſible to imagine that any mode of manufacture could make paper of ſuch a nature, as that a pen drawn over it in a circular direction would leave the figure of a ſquare? as that, "Whether it be poſſible to imagine, that any courſe of education could ever bring a rational creature to believe that two and two are equal to three?"

14 But all derived from ſenſation and reflection.

The mind being thus, as we may ſay, originally white paper, void of all characters, without ideas or notions of any kind, the firſt queſtion which we have to conſider is, Whence and in what manner it derives the materials of all its knowledge? To this queſtion the only anſwer which can be given is, That it derives them from obſervation and experience; from obſervation, either employed upon external objects of ſenſe, or turned inwardly upon its own operations. Our ſenſes, converſant about particular external objects convey into the mind ſeveral diſtinct perceptions; ſuch as thoſe of *colour*, *figure*, *heat*, *cold*, *bitterneſs*, *ſweetneſs*, and all thoſe things which are uſually called *ſenſible qualities*. The notions, ideas, or whatever elſe they may be called, which are acquired in this manner, may be called *ſenſible knowledge*; and the ſource of that knowledge is termed *ſenſation*.

The other fountain from which experience furniſhes the underſtanding with knowledge, is that attention which we are capable of giving to the operations of our own minds when employed about thoſe ideas which were originally ſuggeſted by objects of ſenſe. Theſe operations, when the ſoul comes to reflect on them, furniſh us with a ſet of notions entirely different from the ideas of ſenſe; ſuch as the notions of *perception*, *thinking*, *doubting*, *believing*, *reaſoning*, *knowing*, *willing*, and all the different energies and paſſions of our own minds. Of theſe operations we are always conſcious when we are awake: but it requires, as ſhall be ſhown afterwards, no inconſiderable effort to ſet them, as it were, at a diſtance, to reflect on them and conſider what they are; but when we have made this effort, we acquire notions as diſtinct, and perhaps more important, than thoſe ideas which we receive by the medium of the ſenſes.

Senſation and reflection then furniſh mankind with the firſt materials of all their knowledge. The mind ſeems not to have ideas or notions of any kind which it did not receive by one of theſe ways. By means of the ſenſes it perceives external objects; and by that power which it has of turning its attention upon itſelf, it diſcovers the nature and manner of its own operations.

Although the knowledge which we acquire from *reflection* be of equal importance, and perhaps of greater certainty than that which we receive through the medium of the ſenſes, it comes into the mind at a much later period; both becauſe it is impoſſible that the faculties of the mind ſhould operate without materials, and becauſe it is much more difficult to attend to theſe operations even while they are going on, than to the objects of ſenſe which ſolicit our attention. It is for this reaſon pretty late before children have any notions whatever of the operations of their own minds; and of the greater part of theſe operations the bulk of mankind have no clear or accurate notions during their whole lives. On the other hand, every human being is ſo ſurrounded with bodies, which perpetually and variouſly affect his ſenſes, that a variety of ſenſible ideas force an entrance even into the minds of children. In order therefore to trace the procedure of the underſtanding, and to aſcertain the extent and limits of human knowledge, it ſhould ſeem that we muſt begin with conſidering the external ſenſes, that we may diſcover the manner in which we receive knowledge by means of them, the objects of that knowledge, and its certainty. It is to be obſerved, however, that though we conſider the mind as poſſeſſed of many powers or faculties, and inquire firſt into the nature of that faculty which we conceive to be firſt exerted, this is done merely for the ſake of proceeding in our ſubject with method and perſpicuity. The mind is one ſimple and undivided being; and in every mental energy it is the whole mind, and not any part or portion of it, that is energetic. On this account, it is impoſſible to explain even the nature of ſenſation and perception to him who knows not what is meant by *will* and *underſtanding*; but to every one who is acquainted with the common import of theſe words, and who has read the ſhort ſyſtem of Logic inſerted in this Work, we hope that our theory of perception will be intelligible and convincing.

Chap. I. *Of* Sensation *and* Perception.

Sect. I. *Of Senſation.*

15 Senſation by five organs.

The Supreme Being, who made us and placed us in this world, has given us ſuch powers of mind as he ſaw to be ſuited to our ſtate and rank in his creation. He has given us the power of perceiving many objects around us: but that power is limited in various ways; and particularly in this, that without the organs of the ſeveral ſenſes we perceive no external object. The ſenſes, as every one knows, are five in number, and each communicates its proper ſenſation. It is by the eyes alone that we ſee, by the ears that we hear, by the noſe that we ſmell, and by the tongue and palate that we taſte; the ſenſe of feeling or touch is ſpread over the whole body, for we feel equally by our hands and by our feet, &c. To the powers of perception by the ſenſes it is neceſſary not only that we have all the organs enumerated, but that we have them alſo in a ſound and natural ſtate. There are many diſorders of the eye which cauſe total blindneſs, as well as others which impair without deſtroying the power of viſion. The ſame thing is true of the organs of all the other ſenſes.

All this is ſo well known from experience, that it needs no proof; but it may be worth while to obſerve, that

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that it is known from experience only †. For any thing that we know to the contrary, our Creator might have endowed us with the power of perception by a thousand organs of sense, all different from those which we possess: and it is certain that he himself perceives every thing more perfectly than we do without bodily organs. For it is to be observed, that the organs of sense are different from the being which is sentient.—It is not the eye which sees, nor the ear which hears; these are only the organs by which we see and hear. A man cannot see the satellites of Jupiter but by means of a telescope, nor hear a low voice but by means of an ear-trumpet. Does he from this conclude, that it is the telescope which sees those satellites, or the trumpet which hears that voice? Such a conclusion would be evidently absurd. It is no less absurd to conclude that it is the eye which sees, or the ear which hears. The telescope and the trumpet are artificial organs of sight and of hearing, of which the eye and the ear are natural organs; but the natural organs see and hear as little as the artificial.

† Reid's Essays on the Intellectual Powers of Man.

16 These organs themselves not sentient, but

17 Instruments of sensation.

That this is the case with respect to the eye and the ear, is so obvious, that, as far as we know, it has never been denied. But with respect to the senses of touch, taste, and smell, the truth at first view appears not so evident. A celebrated writer has observed *, that "after the utmost efforts, we find it beyond our power to conceive the flavour of a rose to exist in the mind: we are necessarily led to conceive that pleasure as existing in the nostrils, along with the impression made by the rose upon that organ (c); and the same will be the result of experiments with respect to every feeling of taste, touch, and smell. Touch (he says), affords the most satisfactory evidence, and philosophy detects the delusion." To detect this delusion requires, indeed, no great depth in philosophy; for it is so far from being true that we are necessarily led otherwise than by association, of which the laws shall be explained afterwards, to conceive the pleasure or pain of touch as existing at that part of our body upon which the impression is made, that, as every man must have observed, children previous to experience cannot distinguish the precise place of their bodies which is affected by the touch of any external object. Nay, we believe it will be found upon trial, that if a full grown man, with all the experience of age to guide him, be pricked with a pin on any part of his body which he has seldom handled, and never seen, he will not readily nor at first put his finger upon the wound, nor even come very *near* to the wound. This, however, he would certainly and infallibly do were the sense of touch necessarily conceived as existing at the organ. To these observations objections may perhaps be made, which we cannot stay to obviate; but the following, we think, will admit of none. We appeal to every man who has experienced that particular sensation of touch which Scaliger dignified with the name of a sixth sense, whether whilst those sensations were new to him, he was necessarily led to conceive them as existing at any particular organ. If he was not, it follows undeniably that the organs of sensation are different from the being which is sentient; that it is not the eye which sees, the ear which hears, the nostrils which smell, the tongue which tastes, nor any part of the body which feels: and that it is by experience that we learn to associate our several sensations with those organs upon which the impressions are made.

* Elements of Criticism.

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It is, however, certain that we receive no sensation from external objects, unless when some impression is made upon the organ of sense, either by the immediate application of the object itself, or by some medium which passes between the object and the organ †. In two of our senses, viz. *touch* and *taste*, there must be an immediate application of the object to the organ. In the other three the sensation is occasioned by the impression of some medium passing from the object to the organ. The effluvia of bodies drawn into the nostrils with the breath are the medium of smell; the undulations of the air are the medium of hearing; and the rays of light passing from visible objects to the eye are the medium of sight. These are facts known from experience to hold universally both in men and in brutes. It is likewise a law of our nature perfectly known to all who know any thing of anatomy, that in order to actual sensation the impressions made upon the external organs must be communicated to the nerves, and from them to the brain. First, the object, either immediately, or by some medium, makes an impression upon the organ; the organ serves only as a medium, by which the impression is communicated to the nerves; and the nerves serve as a medium to carry it on to the brain. Here the corporeal part ends; at least we can trace it no farther. The rest is all intellectual.

† Reid's Essays on the Intellectual Powers of Man, and Hartley's Observations on Man.

18 The brain and nerves necessary to sensation.

The proof of these impressions upon the nerves and brain in sensation is this, that from many observations and experiments it is found, that when the organ of any sense is perfectly sound, and has the impression made upon it by the object ever so strongly, yet if the nerve which serves that organ be cut or tied hard, there is no sensation, and it is well known that disorders in the brain deprive us of sensation, while both the organ and its nerve are sound.

19 Process of nature in sensation.

There is sufficient reason, therefore, to conclude, that in sensation the object produces some change in the organ; that from the organ the change proceeds to the nerve, and from the nerve to the brain. Hence it is that we have positive sensations from negative objects, or mere non-entities, such as *darkness*, *blackness*, and *vacuity*. For, sensation resulting from changes in the brain, whatever produces any change must of course

(c) Another eminent writer thinks on this subject very differently, and in our opinion much more justly.—"Suppose (says Dr Reid) a person who never had this sense (viz. *smell*) before, to receive it all at once, and to smell a rose; can he perceive any similitude or argreement between the smell and the rose? or indeed between it and any other object whatever? Certainly he cannot. He finds himself affected in a new way, he knows not why, or from what cause. He is conscious that he is not the cause of it himself; but he cannot from the nature of the thing determine whether it be caused by body or spirit; by something near, or by something at a distance. He cannot give it a *place* any more than he can give a place to melancholy or joy: nor can he conceive it to have any existence but when it is smelled." *Inquiry into the Human Mind*, ch. 2. sect. 2.

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course occasion a new sensation: but it is obvious, that the mere absence of any impression, by the removal of the object which produced it, must as necessarily cause a change in the organ, nerves, and brain, as the presence of a new impression from a new object. To these changes, or that which *immediately* produces them, we give the name of *impressions;* because we know not how, in a general manner, to express more properly any change produced by an external cause, without specifying the nature of that cause. Whether it be pressure, or attraction, or repulsion, or vibration, or something unknown, for which we have no name, still it may be called an impression.

Sir Isaac Newton was perhaps the first who supposed that the rays of light falling upon the bottom of the eye excite vibrations in the *tunica retina;* and that those vibrations being propagated along the solid fibres of the optic nerves into the brain, cause the actual sensation of seeing. This hypothesis was adopted by Dr Hartley, applied to the other senses, and shewn to be at least as probable as any which has yet been invented to account for the perception of external objects by means of the organs of sense. Be this as it may, experience informs us, that whatever be the nature of those impressions and changes which are made by external objects upon the senses, nerves, and brain, we have without them no actual sensation, and of course perceive nothing *ab extra*. Hence it has been supposed, that the mind is wholly passive in sensation, and that sensation is *necessarily* produced by those impressions. But this we believe to be a mistake. Every man who has been attentive to his own thoughts and actions, must know instances of impressions having been certainly made upon his organs of sense without producing any sensation, or suggesting to his mind the perception of the particular objects by which the impressions were caused. He whose mind is intensely employed in any particular pursuit, may have his eyes open upon an object which he does not see; or he may not hear the sound of a clock striking within two yards of him: Nay, we will venture to affirm, that there is hardly one reader of this article to whom such absences of sensation have not often occurred. Now, as there is no reason to suppose, that in the one case the undulations of the air, caused by the striking of the clock did not reach his ears, or that in the other the rays of light, reflected from the object, did not fall upon his eyes, which are open to receive them; the only reason which can be assigned for his not having, in these instances, had audible and visible sensations, is, that his mind was so engaged in something else as not to pay to the vibrations in his brain that attention, if we may so say, without which impressions *ab extra* can produce no sensation. There are, indeed, some impressions on the organs of sense so violent and so sudden, as to force themselves upon the mind however employed. Such are those made on the ear by thunder, and on the eye by strong light. In these cases, sensation is involuntary and unavoidable; whence we conclude, not that in such instances the mind is passive or destitute of energy, but that by the violent agitation given to the brain, it is roused from its reverie, and compelled to give attention. It appears, therefore, that in sensation the mind exerts some kind of energy; for in nothing but in the sentient being itself can we seek for the cause why, when all external circumstances are the same, organical impressions sometimes produce sensations and sometimes not; and that cause can only be the energy of the mind: what kind of energy, we pretend not to say.

20 In sensation the mind is partly active.

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Sect. II. *Of Perception by the Senses.*

21 Difficult to account for the perception of objects.

How the correspondence is carried on between the thinking principle within us and the material world without us, has always, as Dr Reid observes, been found a very difficult problem to those philosophers who consider themselves as obliged to account for every phenomenon in nature. It is, indeed, a problem of which we expect not to see a complete solution. A few steps beyond the vulgar we may certainly go; but the nature of that connection by which the mind and body are united, will probably remain for ever unknown. One question, however, which has employed much of the attention of philosophers, both ancient and modern, appears to be not wholly unanswerable. It is, Whether by means of our senses we perceive external objects mediately or immediately; or in other words, Whether sensation and perception be one and the same thing, or two things succeeding each other? On this subject, till of late, there appears to have been in the main a great uniformity in the sentiments of philosophers notwithstanding their variations respecting particular points. Of some of the most eminent of them, we shall give the opinions as we find them collected by one * who is well acquainted with their writings, who is thoroughly qualified to estimate their respective merits, and who cannot be suspected of partiality to that theory, which we feel ourselves compelled to adopt.

* Dr Reid in his Essays on the Intellectual Powers of Man.

22 The hypothesis of Plato;

"Plato illustrates our manner of perceiving external objects thus: He supposes a dark subterraneous cave, in which men lie bound in such a manner as that they can direct their eyes only to one part of the cave. Far behind there is a light, of which some rays come over a wall to that part of the cave which is before the eyes of our prisoners. A number of men variously employed pass between them and the light, whose shadows are seen by the prisoners, but not their persons themselves. In this manner did that philosopher conceive, that by our senses we perceive not things themselves, but only the shadows of things; and he seems to have borrowed his notions on this subject from the disciples of Pythagoras.

23 Of Aristotle;

"If we make due allowance for Plato's allegorical genius, his sentiments with respect to sensation and perception correspond very well with those of the Peripatetics. Aristotle, the founder of that school, seems to have thought, that the soul consists of two or three parts, or rather that we have three souls—the vegetable, the animal, and the rational. The animal soul he held to be a certain *form* of the body, which is inseparable from it, and perishes at death. To this soul the senses belong: and he defines a sense to be that which is capable of receiving the sensible forms, or species of objects, without any of the matter of them; as wax receives the form of the seal without any of its matter. Of this doctrine it seems to be a necessary consequence, that bodies are constantly sending forth, in all directions, as many different kinds of forms without matter as they have different sensible qualities. This was accordingly

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ly maintained by the followers of Aristotle, though not as far as we know, taught by himself. They disputed concerning the nature of these forms or species, whether they were real beings or nonentities: but of matter and form we shall have occasion to speak afterwards.

24 Of Des Cartes;

"After Aristotle had kept possession of the schools for more than a thousand years, his authority, which had often supplied the place of argument was called in question by Lord Bacon and others. Des Cartes, however, was the first philosopher who, convinced of the defects of the prevailing system, attempted to form another entirely new: but on the nature of perception by means of the senses he differs little or nothing from those who had preceded him in that department of science. He denies, indeed, and refutes by solid reasoning, the doctrine which maintains that *images*, *species*, or *forms* of external objects, come from the objects themselves, and enter into the mind by the avenues of the senses. But he takes it for granted, as all the old philosophers had done, that what we immediately perceive must be either in the mind itself, or in the brain, to which the mind is immediately present. The impressions made upon our organs, nerves, and brain, can be nothing, according to his philosophy, but various modifications of extension, figure, and motion. There can be nothing in the brain like *sound* or *colour*, *taste* or *smell*, *heat* or *cold*. These are sensations in the mind, which, by the laws of the union of the soul and body, are raised on occasion of certain traces in the brain; and although he sometimes gives the name of ideas to these traces, he does not think it necessary that they should be perfectly like the things which they represent, any more than that words and signs should resemble the things which they signify.

"According to this system it would appear, that we perceive not external objects *directly* by means of our senses; but that these objects, operating either mediately or immediately upon the organs of sense, and they again upon our nerves and brain, excite in the mind certain sensations; whence we *infer* the existence of external objects from our sensations of which they are the cause. Perception of external objects, therefore, according to Des Cartes, is not one simple original act of the mind, but may be resolved into a process of reasoning from effects to causes."

25 Of Malebranche;

The doctrines of Malebranche, Locke, and Hartley, respecting perception, differ not essentially from that of Des Cartes. Malebranche, indeed, supposes, that external objects are not themselves the causes of perception; but that the Deity, being always present to our minds more intimately than any other being, does, upon occasion of the impressions made upon our organs of sense, discover to us, as far as he thinks proper, and according to fixed laws, his own ideas of the object: and thus, according to him, we see all things in God, or in the divine ideas. He agrees, however, with Des Cartes and the ancient philosophers, in considering it as a truth which it is impossible to question, that we perceive not the objects without us, the sun, moon, and stars, &c. because it is not likely that the soul sallies out of the body, and takes a walk, as it were, through the heavens to contemplate these objects. She sees them not therefore by themselves; and the immediate object of the mind, when it sees the sun, is not the sun itself, but something which is intimately united to the mind, and is that which he calls an *idea*.

26 Of Locke.

Locke speaking of the reality of our knowledge, says: "It is evident the mind knows not things immediately, but only by the intervention of the *ideas* it has of them." Our knowledge, therefore, according to him, is real only so far as there is a conformity between our ideas and the things which they represent. The manner of our perceiving external objects he illustrates by the following similitude: "Methinks the understanding is not much unlike a closet wholly shut from light, with only some little opening left, to let in external visible resemblances or ideas of things without. Would the pictures coming into such a dark room but stay there, and lie so orderly as to be found upon occasion, it would very much resemble the understanding of a man in reference to all objects of sight, and the ideas of them *" He has elsewhere † defined an *idea* thus: "Whatsoever the mind perceives in itself, or is the immediate object of perception, thought, or understanding, that I call an *idea*; and the power to produce any idea in our mind, I call *quality* of the subject wherein the power is." He likewise thinks it "easy to draw this observation, that the ideas of what he calls primary qualities of bodies, viz. *extension*, *solidity*, *figure*, and *mobility*, &c. are resemblances of these qualities as they really exist in the body themselves."

* Essay on the Understanding, book ii. chap. 11.

† Book ii. chap. 8.

This unguarded expression which affirms that ideas in the mind are the resemblances of external things, has brought upon Mr Locke much undeserved ridicule. That on this and other occasions he uses the word *idea* with too great latitude, and that he often confounds ideas with sensations, and even with the causes of sensation, must be admitted by his warmest admirers: but we believe, that by an attentive reader, who peruses his whole work, and compares such passages as are obscure with those which are clearer, his meaning may always be discovered, and with respect to sensation and perception will generally be found just. That by calling the ideas of primary qualities resemblances of the qualities themselves, he meant nothing more than that bodies in all possible states impress the senses, nerves, and brain, in such a manner as to produce in the mind certain sensations: between which and those impressions there is an inseparable, though unknown, connection, is evident from the account which he gives of the manner of perception. "Our senses (says he), conversant about particular sensible objects, do convey into the mind several distinct perceptions of things, according to those various ways in which these objects affect them: and thus we come by those ideas we have of *yellow*, *white*, *heat*, *cold*, *soft*, *hard*, *bitter*, *sweet*, and all those which we call sensible qualities: which when I say the senses convey into the mind, I mean they from external objects convey into the mind what produces those perceptions." And as bodies can act only by impulse, he adds, that "those perceptions can be produced only by an impression made upon the senses, and some motion thence continued by our nerves to the brain or seat of perception."

27 Of Hartley.

Dr Hartley was the pupil of Locke and Newton; and has, in a more satisfactory manner than all who had

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had preceded or have since followed him, explained the material part of the process of perception. His principles we shall have occasion, during the course of the article, to develope pretty fully. For our present purpose it is sufficient to say, that all his observations and arguments evidently suppose, that nothing distant from the mind can be perceived in the immediate act of sensation; but that the apparently immediate perception of external objects is an instance of early and deep-rooted association.

28 Of Hume.

In this sentiment Mr Hume agrees with his predecessors; but he obscures his philosophy, and misleads his reader, by confounding sensations with the impressions from which they proceed. "Every one (says he *) will allow, that there is a considerable difference between the perceptions of the mind, when a man feels the pain of excessive heat, or the pleasure of moderate warmth, and when he afterwards recals to his memory this sensation or anticipates it by his imagination." The less forcible and lively of these perceptions he with great propriety calls *ideas*; but it is either through wilful perverseness, or confusion of intellect, that he chooses to call the others *impressions*. Sensation and perception are caused by *impressions*; but they are no more impressions themselves, than the pain occasioned by the stroke of a bludgeon is the stroke itself, or the bludgeon with which it was struck. But more of this afterwards.

* Inquiry concerning Human Understanding, sect. ii.

29 Agreement of philosophers, and the reason of it.

Thus far, then, that we perceive not external objects *directly*, but infer their existence from certain sensations excited in our minds by the operation of these objects upon our *senses*, *nerves*, and *brain*, seems to have been the opinion of every philosopher from Pythogoras † to Mr Hume. For an opinion so universal, and at the same time so contrary to the persuasion of the multitude, some cogent reason must have been assigned. That reason has been given by many philosophers, but by none with greater perspicuity than the late Dr Porterfield in his essay concerning the motion of the eyes. "How body acts upon mind, or mind upon body (says he), I know not; but this I am very certain of, that nothing can act, or be acted upon, where it is not: and therefore our mind can never perceive any thing but its own proper modifications and the various states of the sensorium to which it is present. So that it is not the external sun and moon, which are in the heavens, that our mind perceives, but only their image or representation impressed on the sensorium. How the soul of a seeing man sees those images, or how it receives those ideas from such agitations in the sensorium I know not; but I am sure it can never perceive the external bodies themselves to which it is not present."

† See Mosheim's edition of Cudworth's Intellectual System, where the opinions of the philosophers of antiquity are more faithfully collected than in any other work with which we are acquainted.

This reasoning appears to have force; and perhaps, the unanimous agreement of thinking men in all ages has still greater force: yet the doctrine which prevailed so long, and which to Locke appeared so evident as to need no proof, has been lately called in question by some eminent philosophers of England; who, though they allow that we cannot perceive external objects but by means of the senses, yet affirm that they are the objects themselves which we perceive directly; and that in perception there is no association which can be resolved into a process of reasoning from sensations the effects, to external objects the causes. Dr Reid, who was perhaps the first, and is unquestionably the ablest of this class of philosophers, has expressed himself on the subject as follows.

"If we attend to the ACT of of our mind which we call the perception of an external object of sense, we shall find it in these three things: *first*, Some conception or notion of the object perceived. *Secondly*, A strong and irresistible conviction and belief of its present existence. And, *thirdly*, That this conviction and belief are immediate, and not the effect of reasoning ‡." To the first and second of these propositions, we are persuaded that Des Cartes and Locke would readily have assented; nor do we imagine that they would have denied the third, had the author allowed that this strong and irresistible conviction is the consequence of an early and deep-rooted association resolvable into a process of reasoning. This, however, the learned professor does not allow; for he repeatedly affirms, that it is instinctive and original, and that "the constitution of our power of perception determines us to hold the existence of what we distinctly perceive as a first principle, from which other truths may be deduced, but it is deduced from none." With this view of the matter, he could with no propriety attempt to support his own opinion by argument but to the reasonings of Dr Porterfield and others in defence of the Cartesian theory, he replies in the following words: "That nothing can act immediately where it is not, I think must be admitted (D); for I agree with Sir Isaac Newton, that power without substance is inconceivable. It is a conse-

‡ Essays on the Intellectual Powers of Man, Essay II. ch. 5.

(D) One of the most celebrated of Dr Reid's followers thinks otherwise. "That no distinct subject can act upon the mind, is a proposition (says Lord Kames) which undoubtedly requires evidence; for it is not instinctively certain: And, therefore, till the proposition be demonstrated, every man may without scruple rely upon the conviction of his senses, that he hears and sees things at a distance." But his Lordship ought to have known, that Locke and Berkeley, the two philosophers whom he was combating, have no where called in question the conviction of their senses. They do not, indeed, admit, that the external organs are themselves percipient, or that by means of them the mind can *immediately* perceive distant objects; but they have no where denied that through the *medium* of them the mind comes to the knowledge of external existence. And the reasons which they assign for this twofold opinion are, that in perception they experience action or the effects of action, which is not their own; and that it is an intuitive truth that nothing can act where it is not present. "But admitting (says his Lordship) that no being can act but where it is, is there any thing more simple or more common, than the acting upon subjects at a distance by intermediate means? This holds in fact with respect both to seeing and hearing." It certainly does, and with respect to the other senses likewise; but it is the very thing for which Locke and Berkeley would have contended, had any man in their days presumed to call it in question. It is the very foundation of their system; and if it be granted, nothing can be more evident than that external existence is not the *immediate* object of perception. See *Appendix to Elements of Criticism.*

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consequence of this, that nothing can be acted upon immediately where the agent is not present: let this, therefore, be granted. To make the reasoning conclusive, it is farther necessary, that when we perceive objects, either they act upon us, or we act upon them. This does not appear self-evident, nor have I ever met with any proof of it ‡."

‡ Essays on the Intellectual Powers of Man, Essay ii. chap. 14.

Of the profundity of Dr Reid's understanding, we have the most firm conviction; nor is there any metaphysician, ancient or modern, from whom we differ with greater reluctance: but we cannot help thinking this a very rash assertion, as his own works appear to us to afford complete proof, that, in preception, the mind both acts and is acted upon. Let us attend however to the reasons which, on this occasion, induce him to think that in preception there is no action either of the object on the mind or of the mind on the object.

"When we say, that one being acts upon another, we mean, that some power of force is exerted by the agent, which produces, or has a tendency to produce, a change in the thing acted upon. If this be the meaning of the phrase, as I conceive it is, there appears no reason for asserting, that in preception, either the object acts upon the mind or the mind upon the object. An object, in being perceived, does not act at all. I perceive the walls of the room where I sit; but they are perfectly inactive, and therefore act not upon the mind. To be perceived, is what logicians call an external denomination, which implies neither action nor quality in the object perceived."

32 We think unsuccessfully; and

This last sentence we pretend not to understand. Substance without qualities is to us inconceivable, and certainly is no object of perception; for Dr Reid himself has told us, and told us truly, that "the objects of preception are the various qualities of bodies." That an object in being perceived does not act at all, is directly contrary to what the ingenious author has taught us, both in his *Inquiry* and in his *Essays*, viz. that "it is a law of our nature that we perceive not external objects, unless certain impressions be made by the object upon the organ, and by means of the organ upon the nerves and brain;" for if the external object in being perceived make impressions, it is certainly not true that it acts not at all. It is indeed readily acknowledged, that when one perceives the walls of the room where he sits, these walls do not act immediately upon the organs of sight; but it does not, therefore, follow that they are perfectly inactive: for it is known to all mankind, that from every point of the wall which is seen, rays of light are reflected to the eye; that those rays make upon the *retina tunica* an impression, which is conveyed by the optic nerve to the brain; and that this impression on the brain is one of the immediate causes of vision. In what *particular manner* it causes vision, we shall never be able to discover, till we know more of the laws which unite mind and body, and by which one of these is qualified to act upon the other; but because we know not the *manner* of this operation, to affirm that there is no operation at all, seems to be as absurd as it would be to affirm, because we perceive no necessary connection between a stroke and the sensation of sound, that the sound of a musical string is not caused by the stroke of a plectrum. That God might have given us powers of perception of a different kind from those which we possess, there can be no doubt; but with what we might have been, we have no concern. As we are, we know perfectly that the eye is an instrument of vision, because without it nothing can be seen: we know also, that the retina and optic nerves are equally necessary; because if they be disordered, vision is still wanting: we know likewise, that the brain is necessary to all perception; because when it is disordered, thinking either entirely ceases or is proportionably disturbed. And, lastly, we are not more certain of our own existence, than that *actual perception* takes not place but when the object makes an impression upon some organ of sense: for when no rays of light fall upon the eye, we see nothing; when no sapid body is applied to the tongue and palate, we taste nothing; and if we could be removed from every thing solid, we would feel nothing. These are conclusions which cannot be controverted. They are admitted equally by the philosopher and by the plain unlettered man of common sense; nor are they rendered one whit less certain by our not being able to go a step farther, so as to discover in what *manner* the brain or the affections of it can be the immediate instrument of sensation and perception. For (as Dr Reid, in the spirit of true philosophy, observes ‡), "in the operations of mind, as well as in those of bodies, we must often be satisfied with knowing that certain things are connected and invariably follow one another, without being able to discover the chain that goes between them. It is to such connections that we give the name of *laws of nature*: and when we say that one thing produces another by a law of nature, this signifies no more, but that one thing which we call in popular language *the cause*, is constantly and invariably followed by another which we call *the effect*; and that we know not *how* they are connected."

‡ Inquiry into the Human Mind 4th edit. p. 258.

In the preceding section we have observed, that in sensation the mind exerts some energy: and therefore, as on every hypothesis perception is a consequence of sensation, it follows, that in preception the mind cannot be wholly inactive. Dr Reid, in his essays on the Intellectual Powers of Man, seems to affirm that it is. "I see no reason (says he) to believe, that in perception the mind acts upon the object. To perceive an object is one thing, to act upon it is another: Nor is the last at all included in the first. To say that I act upon the wall, by looking at it, is an abuse of language, and has no meaning." This is indeed true: it would be a great abuse of language to say, that by looking at the wall a man acts upon it; but we do not believe that any man ever said or supposed such a thing. The philosophers whose opinion he is combating, might argue in this manner. We are conscious that in perception the mind is active; nothing can act immediately where it is not; the mind cannot act immediately upon external existence: external existence, therefore, is not the immediate object of that energy which is exerted in perception. As Dr Reid affirms that external existence is the immediate object of perception, he must deny the first proposition in this argument; for *if it* be granted, as we have just seen that in his reply to Dr Porterfield he admits the

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second, the laws of reasoning will compel him to admit the third. To say, that in perception the mind acts not upon *external* objects, is a truth in which all mankind are agreed; and it is the very principle from which his antagonists infer, that the conviction of the present existence of external objects is not an original and instinctive consequence of sensation, but an early and deep-rooted association which may be resolved into a process of reasoning. His meaning, therefore, must be, that in perception the mind *acts not at all:* but this is directly contrary to his definition of perception, which he calls an ACT of the mind: it is likewise contrary to this theory of perception, as it is detailed in *the Inquiry into the Human Mind on the principles of Common Sense.* We are there taught, with equal elegance and perspicuity, "that an impression made by an external object upon the organ, nerves, and brain, is followed by a *sensation*, and that this sensation is followed by the preception of the object." We are likewise taught, that "although the Peripatetics had no good reason to suppose an active and passive intellect, they yet came nearer the truth, in holding the mind to be, in sensation, partly passive and partly active, than the moderns in affirming it to be purely passive. Sensation, imagination, memory, and judgment, have by the vulgar, in all ages, been considered as acts of the mind. The manner in which they are expressed in all languages shows this: for when the mind is much employed in them, we say, it is very active; whereas, if they were impressions only, we ought to say that the mind is very passive." All this is undeniable; but if sensation necessarily precede perception, and if in sensation the mind be active, what becomes of the assertion, that in perception it acts not at all? Indeed we may appeal to the common sense of mankind, whether any thing can be perceived without some mental energy of the percipient. For when the impressions made on the external senses are faint, in order to be conscious of them an evident exertion is requisite, not of the organ only, but also of the mind, as in perceiving very remote objects and sounds; but when the impressions are stronger, the perception is involuntary and unavoidable, as has been already explained in the preceding section.

33 Therefore the old theory of perception to be preferred to his.

It being thus certain that in perception the mind both acts and is acted upon, and it being universally acknowledged that nothing can act where it is not, we feel ourselves compelled to admit with the Cartesians, that in perception the conviction of the present existence of external objects is not original and instinctive, but the consequence of an early and unavoidable association of certain sensations with the causes which produce them. In this opinion we are still more confirmed by the well-known fact, that particular pressures upon the organ, nerves, and brain, excite not only sensations, but even perceptions of objects apparently external, when no such objects are within the reach of our senses. Thus §, if a man in the dark press either corner of his eye with his finger, he will see a circle of colours like those in the feather of a peacock's tail, though no such external object be before him, and though the room be so dark that nothing external could possibly be seen. Again, if a burning coal be nimbly moved round in a circle, with gyrations continually repeated, the whole circumference of the circle will at once appear on fire, though it is certain that there can be really on fire but one portion of that circumference, equal in length to the diameter of the coal. These are facts known to all mankind; and they are perfectly irreconcileable with the supposition, that the perception of external objects by the sense of sight is original and instinctive; but they are at once accounted for, if it be true that rays of light falling from external objects upon the *retina tunica* agitate the optic nerves and brain, and that such agitations excite sensations in the mind which experience has taught us to refer to external objects, as, under God, their ultimate cause.

§ Hartley's Observations on Man.

But though we have declared ourselves to be in this instance Cartesians, we do not admit all the absurdities which have sometimes been imputed to that system of perception. We do not believe that external objects are perceived by means of images of them in the mind or the brain; nor do we think that Des Cartes or Locke has any where affirmed that they are, otherwise than by an expression obviously figurative, denoting, not that the actual shapes of things are delineated in the brain or upon the mind, but only that impressions of some kind or other are conveyed to the brain by means of the organs of sense and their corresponding nerves; and that between those impressions and the sensations excited in the mind, there is a real, and in our present state a necessary, though unknown, connection.

34 That theory fairly stated, and

Upon the whole, we think that there is good evidence for believing, that in perception the process of nature is as follows: *First*, If the object be not in contact with the organ of sense, there must be some medium which passes between them; as, in vision, the rays of light; in hearing, the vibrations of elastic air; and in smelling, the effluvia of the body smelled; otherwise we have neither sensation nor perception. *Secondly*, There must be some action or impression upon the organ of sense, either by the immediate application of the object, as in the two senses of touch and taste; or by the medium that goes between them, as in the other three senses. *Thirdly*, The nerves which go from the brain to the organ, must receive some impression by means of that which was made upon the organ; and by means of these nerves that impression must be carried to the brain. *Fourthly*, The impression made upon the organ, nerves, and brain, rouses the dormant energy of the mind; and this double action of the mind and the object produces a sensation. And, *lastly*, As we know by experience that the mind alone cannot by an exertion of its own produce one sensation, and are intuitively certain that nothing can be begin to exist without a cause, we infer from the existence of any new sensation the existence of some other cause than the internal energy of the mind, from which that sensation proceeds; and this cause experience teaches us to be the external object. This process is carried on so rapidly, and the several parts of it, by being continually repeated, are so closely associated, that except by a reflex act of the mind we distinguish them not from one another, and therefore we denominate the whole *perception.*

35 Shown to differ little from Dr Reid's.

It is with extreme diffidence that we advance a doctrine which Dr Reid has controverted: but he differs from us only in the last stage § of the process, where he supposes sensation and perception to be two simple and independent acts of the mind. Yet he sometimes expresses

§ See Inquiry into the Human Mind, 4th edit. p. 383.

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expresses himself, as if he thought as we do, that in perception the belief of the present existence of external objects is rather the result of experience that an instinctive persuasion. Thus speaking of the perception which we have in smelling a rose, he says §, "Perception has always an external object, and the object of my perception in this case is that quality in the rose which I discern by the sense of smell. Observing that the agreeable sensation is raised when the rose is near and ceases when it is removed, I am led by my nature [we think *by experience* would have been more proper] to conclude some quality to be in the rose, which is the cause of this sensation. This quality in the rose is the object perceived; and that act of my mind, by which I have the conviction and belief of this quality, is what in this case I call perception" Again (he says) that "three of our senses, viz. smell, taste, and hearing, originally give us only certain sensations, and a conviction that those sensations are occasioned by some external object. We give a name to that quality of the object by which it is fitted to produce such a sensation, and connect that quality with the object and with its other qualities. Thus we learn, that a certain sensation of smell is produced by a rose; and that quality in the rose by which it is fitted to produce this sensation we call the *smell of the rose*. Here it is evident that the sensation is original. The perception that the rose has that quality which we call its *smell*, is acquired."

§ Essays on the intellectual Powers of Man, Essay ii. chap 15, and 21.

To this doctrine no Cartesian could possibly object; for it is the very account which Des Cartes himself would have given of perception by the organ of smell, as it resolves such a perception into an early association between a certain sensation and that external quality from which we know by experience that the sensation proceeds. Indeed the excellent author repeatedly affirms, that every different perception is conjoined with a sensation which is proper to it; and that the one is the sign, and the other the thing signified. He likewise doubts *, whether children, from the time that they begin to use their senses, make a distinction between things which are only conceived or imagined, and things which really exist. But if the conviction of the present existence of external objects were in perception *instinctive*, we cannot see how there could be room for such a doubt: for the mere senses of children are as perfect as those of full grown men; and they know well the difference between actually sucking their nurses and only thinking of that operation, though they be not capable of expressing that difference in language.

* Essays on the Intellectual Powers of Man.

36 Both theories afford intuitive evidence that something exists besides the perception and the sensation.

But if in perception our conviction of the present existence of external objects be not instinctive, what, it may be asked, is the evidence that such objects really exist? This question we shall partly answer in the following section, and more completely when we come to examine Berkeley's theory of the non-existence of matter: but from what has been said already, it is sufficiently evident, that every sensation compels us to believe in the present existence of something different from ourselves, as well as from our sensations.

Objects of the respective Senses.

SECT. III. *Of the Objects of each Sense respectively.*

37 Touch, the sense by which we perceive heat and cold, &c.

HITHERTO we have considered sensation and perception in general, and shown that is not by instinct that we perceive the existence of external objects. This will appear more clearly, if we can ascertain the precise nature of that information which each sense affords us: and in order to this, we shall begin with the sense of *touch*, not only because it is that which is certainly first exercised, but also because there is a meaning in which all the others may be resolved into it.

38 The nature of heat and cold, which are perceived immediately.

By means of touch we perceive many things; of which the chief are, heat and cold, hardness and softness, roughness and smoothness, extension, figure, solidity, and motion. Of these perceptions, some are immediate; and others, as we are persuaded, early associations, which may be resolved into a process of reasoning. The perceptions of heat and cold are immediate. When a person for the first time in his life approaches the fire, he feels heat; and when he is first exposed to the frost, he feels cold. What are heat and cold, and where do they reside? They are obviously the reverse of each other; but are they external objects or mere sensations in the mind? They are undoubtedly sensations which have no existence but when they are felt. To every man not altogether a stranger to these speculations, this proposition is self-evident; but to the bulk of the people it appears an extravagant paradox. To make it plain, however, to the meanest capacity, it is sufficient to observe, that at a certain distance the fire has no perceptible influence upon any person; if that distance be lessened, we feel an agreeable warmth; approach a little nearer, and the warmth becomes disagreeable; and still nearer, it will rise to pain. No man supposes the pain inflicted by a sword to exist in the sword, or any where else but in a sentient being: It is equally absurd to suppose pain to exist in fire, or any where else but in a sentient being. But that which at one distance is pain, at another is only agreeable warmth; and since warmth and pain are only different degrees of the same feeling, it is equally absurd to suppose the one as the other in the fire. What then is the object of sense when we feel heat? There is obviously no object beyond the present sensation.

39 Their external causes.

But has the sensation of heat no cause independent of us? Undoubtedly it has, and experience teaches us that the cause is in the fire. We know that we cannot produce the sensation of heat in ourselves by any mental energy of our own; and we are intuitively certain, that nothing can begin to exist without some cause. A man on the top of a mountain covered with snow, may imagine or remember what he felt when in the neighbourhood of fire, and thus have in his mind what is called an *idea* of heat; but that idea will not warm him (E) like the actual sensation, which no exertion of his own can in such circumstances produce. When

(E) ——Who can hold a fire in his hand,
By thinking on the frosty Caucasus?
Or cloy the hungry edge of appetite,
By bare imagination of a feast?
Or wallow naked in December's snow,
By thinking on fantastic summer's heat?
Oh no! the apprehension of the good
Gives but the greater feeling to the worse.
K. RICHARD II.

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When he leaves the mountain, however, and approaches the fire, he feels the sensation actually produced, and produced as often as he makes the experiment. He is, therefore, under the necessity of inferring, that in the fire there is some power or quality which, acting either mediately or immediately upon his sense of touch, excites the feeling which is called *heat*. What that power is, we shall perhaps never be able to discover; but it is self-evident, that it is neither heat nor the resemblance of heat, though in vulgar language it is known by that name.

The same reasoning holds good with respect to cold. There is at certain times, and in certain countries, some power in the air which congeals water and causes cold; but that power is as different from the sensation of cold, as the power of fire is different from the sensation of heat, or the point of a sword from a flesh wound.

40 The perceptions of extension and figure, &c. not immediate.

By the sense of touch we perceive extension, figure, and solidity, &c. but we do not perceive them *immediately* as we perceive heat and cold; for extension, figure, and solidity, are not sensations. Those perceptions must then be acquired; and more clearly to ascertain the manner in which we acquire them, let us suppose a man from his birth destitute of the sense of sight and the power of local motion, but possessed of intellect and every other faculty which we enjoy—Such a person, it is obvious, would be capable of every sensation and perception which is *original* to us, except the perception of colours; but we doubt whether it would be possible to give him perceptions of extension, figure, and solidity. Let us try: and as he cannot move a single limb or member of himself, let as suppose a solid substance of small dimensions to be gently pressed against any part of his body; what would such pressure communicate to him? We think it could communicate nothing but a new sensation, to which, as it is neither pleasing nor painful, no name has hitherto been given, except the general one of *feeling*. This sensation he would not know whether to refer to an external or internal cause; or rather he would have no notion whatever of an external cause, though he would at the same time be conscious that the new sensation was not excited by any energy of his own will. Were the pressure to be gradually encreased till it rose to pain, our blind man would still be conscious of nothing but a sensation, which could not lead him to the notion of extension, figure, or solidity, because mere sensations cannot be conceived as either solid or extended. Let us next suppose the pressure to be applied successively to different parts of his body; he would now indeed be conscious of successive sensations, but he could not assign to them either extension or *place*: for it has been already shewn that the external parts of the body are not themselves sentient; and it shall be shewn afterwards, that to a man who has never perceived motion, place is absolutely inconceivable. Lastly, let us suppose the dimensions of the pressing substance to be greatly enlarged: what would then follow? nothing, we apprehend, but an increase of pain: for though the whole body were pressed *ab extra*, the pressure could affect the individual being which is sentient, not more extensively, but only more violently. It appears, therefore, that a man blind from his birth, and destitute of the power of local motion, could never be made to perceive extension, figure, or solidity.

Objects of the respective Senses.

41 How they are acquired.

Let us now suppose this man to receive by a miracle the use of his limbs, and to be suddenly prompted, by some instinctive impulse, to arise and walk. So long as he met with no obstacle in his way, he would not, we apprehend, acquire by this exercise any correct notions of extension or figure; but were a stone or log of wood of considerable dimensions to be laid across his usual walk, the case would soon be altered. He would feel himself interrupted in his course, and he would at the same time recognize his wonted sensations of touch. After being twice or thrice thus interrupted he would learn from experience that that interruption or resistance proceeded from the same cause which in this instance communicated to him the sensation of feeling; and were he to run his hand along the surface of a log or stone, he would perceive the resistance and sensation continued. As every effect must have an adequate cause, this continued resistance would compel him to believe the continuity of something external in every direction in which he felt his hand resisted; but such continuity of being is all that is meant by the word extension. At the very same time, and by the very same means, he would gradually acquire the perception of figure; for by running his hand in every direction over the surface of the obstacle which opposed him, he would soon perceive it on all sides limited; but the limits of extension is a phrase of precisely the same import with figure. It appears, therefore, that without the power of local motion, men could never by the sense of touch acquire the notions of extension and figure; and the same will be found to be the case with respect to hardness and softness.

42 Hardness and softness, how perceived.

When we press our hand gently against a stock or a stone, we feel a sensation which is neither painful nor pleasing. When we press it more violently, the sensation becomes painful, and we experience in the object a resistance which we have not power to overcome. When we press butter or pomatum very gently, we have a sensation in all respects similar to that which we felt when we gently touched the stock or the stone. But when we press the butter with violence, we feel no pain, and experience little resistance; for the parts of which it is composed give way before the hand, though the parts of the stock or the stone remained fixed and immoveable. That the parts of the body should thus resist a pressure to which the parts of another so readily yield, must proceed from some difference in the texture of the two bodies: for by the sense of touch we perceive the effects to be different; and are therefore certain that they must proceed either from different causes, or from the same cause operating with different degrees of force. That particular texture which makes the parts of a stone resist the pressure of touch, we call hardness; and the texture which makes the parts of butter or pomatum give way to touch, we call softness. But what hardness and softness are in themselves, touch cannot inform us; for they are neither sensations, nor similar to sensations. We acquire, however, by experience, so complete notions of hardness and softness, that every one who understands the English language perfectly knows the meaning of these words as soon as he hears them; and when he is told that

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that one body is hard and another soft, he knows with absolute certainty that the meaning of the assertion is, that the parts of the body which is said to be hard are held together by some unknown cause operating forcibly, and that the parts of the other are held together by the same or a similar cause operating with less force.

43 Roughness and smoothness.

We acquire the notions of roughness and smoothness in the very same way and by the very same means that we acquire ideas of extension and figure. To describe the process at large would certainly be superfluous; for if what we have said concerning our perceptions of extension and figure be just and intelligible, every one will, without farther assistance, discover for himself how he perceives roughness and smoothness. *Motion* shall be considered among the adjuncts of body; but in order to understand what body itself is, it will be necessary, before we dismiss the sense of touch, to inquire how we come by the notion of solidity.

44 Solidity, what; and how perceived.

Solidity is one of those notions, or, in the language of Locke, one of those ideas, which are commonly said to be acquired by the sense of touch. That touch gives the first hint towards our notion of solidity, is certainly true; but that hint must be afterwards improved by the intellect, or we never could have an adequate knowledge of what is meant when any thing is said to be absolutely solid. We know by experience, that we can at pleasure open and shut our empty hand without meeting with any resistance. We know likewise, that when we grasp an ivory ball of three or four inches diameter, no force which we can exert will bring together the several parts of the hand, which were easily brought together when we grasped nothing. In this way do we acquire our first notion of solidity; for that word denotes nothing more in this instance than the power or property of the ball, by which our fingers are excluded from the place which it occupies. Solidity differs from hardness in this respect, that hardness results from the strong cohesion of the parts of a hard body, which renders it difficult to change the places of those parts, as they respect one another; whereas solidity respects the whole mass, and is as essential a quality of water as of adamant. A drop of water, indeed, placed between two plane surfaces of marble, will not like adamant preclude their contact; because the parts of a drop of water, cohering but loosely to one another, give way to the pressure, and escape in every lateral direction. But if a drop of water be confined on all sides, as in a globe of gold, we know from experiment that no force will bring the sides of the globe together without forcing the water through the pores of the metal; and hence we infer solidity to be essential to every corporeal substance.

Thus then it appears, that of the objects perceived by touch not one is *immediately* perceived except heat, cold, and other sensations. The sensations, as they are not excited by any internal energy of our own, lead us indeed to something external as their cause; and by comparing the different sensations with each other, and observing what effects their external causes have upon our own motions, we are naturally led to conceive these causes as extended, figured, solid, hard or soft, rough or smooth, &c.; but it is obvious that this conception is the result of experience, and a process of mental reasoning.

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On the senses of taste, smell, and hearing, it is needless to say much. The immediate objects of these are confessedly sensations which have no existence but when they are perceived; though experience teaches us to refer them all to external objects as their respective causes. With respect to smell, this has been made sufficiently evident in the preceding section, and it is not less evident with respect to taste and hearing.

45 Nothing but mere sensations the objects of smell,

46 Taste, and

Certain bodies applied to the tongue and palate, and moistened with the saliva, excite certain sensations which we call tastes. These sensations, however, are not in the bodies; nor can they have any existence but in a sentient being. They are produced in consequence of impulses on the nerves of the tongue and palate, exciting certain agitations in the brain; but the sensation itself is neither impulse nor agitation. Some substances excite tastes which are agreeable, and others such as are disagreeable; and there are not a few which excite no taste at all. Bodies, which applied to the tongue and palate of one man produce tastes that are agreeable, applied to the same organs of another man give him tastes which are disagreeable; and we have all experienced, that the same substance, which, when the organs are sound, excites a sweet or pleasant taste, has, when the organs were disordered, excited a taste which was bitter or unpleasant. These facts, which cannot be controverted, afford the fullest evidence, if evidence were wanted, that taste, as we feel it, is no quality of bodies, nor has any existence out of the mind.

47 Hearing.

The organ of hearing is the *ear*, and its object is sound. It is well known, that sound is produced by certain vibrations of the air striking the tympanum of the ear, and that those vibrations are caused by the sonorous body. Sound, however, is not vibration, nor the idea of sound the idea of vibration. Sound considered by itself is a mere sensation, which can have no existence but in a sentient being. We know by experience, that it is caused by something external; but we know likewise that the effect has no resemblance to the cause. Previous to experience we could not refer sound to any external cause; far less could we discern whether it proceeded from an object above us or below us, on our right hand or on our left. It appears to us self-evident, that if a man born deaf were suddenly made to hear, he would consider his first sensation of sound as originating wholly within himself. Between that sensation and the sensations of touch, taste, smell, and sight, there is no resemblance; nor are there any relations among them, which, previous to experience, could induce him to trace them all to external objects as their several causes. Our deaf man might have learned to refer all his other sensations to their true causes, in some such way as we have described under the sense of touch; but sound would be something so new to him, and so totally different from touch, taste, and smell, that he could attribute it to nothing external.

48 It is by experience that we distinguish different sonorous bodies by their respective sounds.

Experience, however, would soon teach him, that the ear is its organ, and the sonorous body its cause; and he would in time learn to distinguish one sound, that of a trumpet for instance, from another, suppose the sound of a bell; and to attribute each to its proper cause, even when neither the trumpet nor the bell was perceived by his other senses. With respect to sounds

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sounds which we have been accustomed to hear, this is done so instantaneously, that some philosophers have imagined it to be the effect of an instinctive principle in our nature, totally different from experience, and independent of reason. But the fact is not so. Long before we are capable of making sensation and perception objects of reflection, we have heard the sound produced by the ringing of a bell, and seen the object which produced the sound so often, that, when we hear a similar sound again, we instantly refer it to a *bell*, though we see not the bell from which it proceeds: but this is the effect of habit, and not of instinct. Had we never perceived a bell while ringing by either of our senses of sight or touch, we could not by the sense of hearing acquire any notion of the figure or texture of the body from which the cause of the sound proceeds, tho' we had heard that sound every day of our lives. It is, indeed, by experience only that we learn to distinguish by the ear whether a sonorous body be before or behind us, on our right hand or on our left; for we find it always difficult to say from what precise quarter a strange sound proceeds; and this difficulty would be heightened to impossibility, had not all sounds something in common. Dr Sparman relates, that when he first heard the roaring of a lion, he did not know on what side of him to apprehend danger, as the sound seemed to proceed from the ground, and to inclose a circle of which he and his companions stood in the centre. The same thing has happened to every man, when the sound was such as he had never heard before; even though it was neither so loud nor so terrific as the roaring of a lion in a desert wilderness: but with respect to sounds which we are daily hearing on each side of us, we soon learn to distinguish with tolerable accuracy whether they be before or behind us, above or below, on our right hand or on our left. All this, however, is the effect, not of instinct, but of experience improved into habit.

49 Sight originally perceives nothing but colours, which are mere sensations.

Sight is justly considered as the noblest and most comprehensive of all our senses. The reason is obvious: for when a full-grown man opens his eyes, he perceives houses, trees, rivers the earth, sun, and moon, &c. and to each of these objects belong figure, extension, colour, &c. which are all perceived instantly by means of this sense. Yet it is certain, that the sense of sight does not originally communicate to us so many perceptions; and there is abundant evidence, that an infant cannot at first, or for some weeks after its birth, distinguish by vision one object from another. *Colour* is the proper object of sight, and for some time its only object; but colour as perceived by us is a mere sensation, which can have no existence but in a sentient being. If this proposition stood in need of proof, we might observe that there are men, and even whole families, who possess the sense of sight in a degree of perfection sufficient for all the purposes of life, and yet cannot distinguish certain colours from each other; blue, for instance, from green, or perhaps from red: and there is no man who can distinguish between some particular shades of blue and green by the feeble light of a candle. Were colours the real qualities of body, this mistake of one for another could never be experienced. No man who possesses the sense of touch ever confounded hardness with softness, a sphere with a cube, or an ell with an inch. The reason is, that hardness and softness, figure and extension, are the qualities of things external; whereas colour being a mere sensation, is nothing but an affection or modification of the sentient being. But it is obvious, that sentient beings, according as they differ from one another, may be differently affected by the same external cause; so that one man may perceive that to be green which all other men perceive to be blue. The immediate external cause of the sensation of colour, is the rays of light reflected from the body, which in common language is said to be coloured. These rays falling upon the pupil of the eye, are refracted differently, according as their incidence is more or less oblique into points on the retina, where they form a picture of the external object; and from the picture, by means of the optic nerve, is communicated to the brain some impulse or agitation, which produces vision or the perception of colour. As rays of light are corporeal substances, it is obvious that they can act upon body only by impulse; but between impulse and the various sensations of *red*, *green*, *blue*, &c. there is no resemblance. For the laws of reflection and refraction, and for the structure of the eye, see Optics and Anatomy. That which we have to inquire into at present is, how we learn, by means of the sense of sight, to perceive the figure, magnitude, motion, and distance of external objects, or indeed to distinguish one object from another.

A ray of light proceeding, as all rays do, in a straight line, must, however great its length, affect the eye, retina, and optic nerve, as if it were a single point. From this obvious and undeniable fact, Bishop Berkeley predicted *, that a man born blind, who should be suddenly made to see, would at first perceive nothing without him, would distinguish neither the distance, size, figure, nor situation, of external objects; that he would only see in his eyes themselves, or, to speak more properly, would only experience new modifications in his mind, until joining *touch* to *sight*, he formed thus a communication with the external world, and learned, by the simultaneous exercise of the two senses, that natural language in which the *visible* is the sign of the *tangible*. This truth, which was discovered by the Bishop merely by contemplating in his own mind the nature of sensation, and the known laws of optics, after having been laughed at for more than 20 years as one of the many dreams of a visionary genius, was completely confirmed by the case of the famous patient whom Cheselden cured of a cataract; and that too, though the cataract does not produce total blindness: which makes it evident, that the first visual perceptions of the patient after his recovery could not be wholly new and unmixed. It may indeed be confirmed at any time by a simple experiment made upon an infant. For several weeks after birth, a child shuts not its eyes upon the sudden approach of an object to them, nor shows the least symptom of distinguishing one distance from another; and it is easy by a little attention, to observe, how it gradually learns to distinguish objects at greater and greater distances. Indeed colour, or the immediate object of sight, being a mere sensation or affection of the mind, can have no natural relation whatever to any thing external.

* Essay towards a new Theory of Vision.

It is plain, therefore, that distance is in its own nature

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50 Perception of distance by sight, how acquired.

ture imperceptible to the eye, and yet it is often perceived by sight. How is this done? We think, in the following manner. Distance is one mode of extension, which we have already seen, is perceived by means of touch. Of short distances, our first ideas are doubtless acquired by the stretching out and drawing back of our arms; and those ideas are soon so connected with certain sensations which we have in actual vision, that the latter instantly suggests the former. Thus, it is a fact known by experience, that when we look at a near object with both eyes, according as it approaches or recedes from us, we alter the disposition of our eyes, by lessening or widening the interval between the pupils. This disposition, or turn of the eyes, is attended with a sensation of which every man is conscious at the time of vision; and this sensation seems to us to be that which in this case suggests the idea of greater or less distance to the mind. Not that there is any natural or *necessary* connection between the sensation of which we are conscious, and greater or less distance; for the sensation is wholly internal, and the distance is external: But because the mind has by constant *experience*, found the different sensations occasioned by different dispositions of the eyes to correspond to different degrees of distance in the object, there has grown an habitual or customary connection between those sensations and the notions of greater or less distance. So that the mind no sooner perceives the sensation arising from the different turn it gives the eyes in order to bring the *pupils* nearer or farther asunder, than it is instantly impressed with a certain notion of the distance which was wont to be connected with that sensation. Again, an object placed at a certain distance from the eye, to which the breadth of the pupil bears a sensible proportion, being made to approach nearer, is seen more confusedly; and the nearer it is brought, the confusion is always the greater. The reason of all this is known to every optician: but it being constantly experienced by those who never dipt into optics, there arises in the mind of every man an habitual connection between the several degrees of confusion and distance; the greater confusion still implying the less distance, and the less confusion the greater distance. It is of no avail to say, that between confused vision and distance, great or small, there is no necessary connection: for there is as little connection between a blush in the face and the mental feeling of shame; and yet no sooner does a man of observation perceive that particular colour in the face of another, than it suggests to him the notion of that feeling or passion with which he has constantly observed it accompanied.

In these ways, however, we perceive only small distances. Of distances more remote our judgment is formed from other data; and happily these data are not far to seek. It is a fact known to every man who is not totally ignorant of the science of optics, that a greater number of rays fall upon the eye when reflected from a body near at hand, than can fall from the same body at a distance; and as those rays operate by impulse, it is self-evident that the impression must be stronger, and of course the sensation or colour more vivid, when the body is near than when it is distant. Now having acquired the notion of the true distance of objects by motion and the sense of touch, and finding by uniform experience, that as they are near or far off, the sensation of colour which they excite in the mind through the organ of vision is more or less vivid, those degrees of sensation come to be so closely associated with the respective distances of the object, that the one instantly suggests the other.

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51 How figure is perceived by sight.

It is just so that we perceive figure by sight. Having experienced by the sense of touch that one surface is a square and another a circle, that one body is a cube and another a sphere; and finding our sense of sight differently affected by the square and the circle, by the cube and the sphere; these different affections come to be so closely connected in our minds with the figures of the respective bodies, that long before we are capable of reasoning on the subject the one is never present to us without suggesting the other. Nay, so complete in this case is the connection or association, that we cannot even in idea abstract the colour from the figure; though it is certain that colour is a mere sensation, and figure an external quality; that colour alone is immediately perceivable by the eye, and the notion of figure suggested by the colour. We are aware that it has been affirmed, and affirmed with great vehemence, that figures of two dimensions are immediately perceived by the eye, and perceived with greater accuracy than by the sense of touch. But they who insist upon this doctrine affirm likewise, contrary to experience and the clearest reasoning, that the immediate objects of sight are external, and that colour is a quality of bodies. In the arguments too by which they support their hypothesis, they seem to confound sight as an affection of the mind, with the picture on the bottom of the eye, as if the retina were the sentient being; whereas the retina and picture are no more than instruments of sensation. It is indeed a fact, that the picture has the same figure nearly with the plane of the object which is presented to the eye; as when the object is a sphere, the picture is a circle variously shaded in colour. It is likewise a fact, that the picture is enlarged in proportion as the object is brought near, and diminished as it is carried to a distance. But these facts are known only to persons skilled in optics; and therefore it is evident, that though calculations may be raised from them by mathematicians to determine the distance and figure of external objects, they cannot possibly be the data from which distance and figure are inferred by the vulgar, who know not that such pictures on the retina exist. Besides all this, it is universally known, that a painter, by laying on his colours properly, can make a plain square surface appear to the eye in certain positions as an oblong or as a cube, and a plain circular surface as a concave or a convex hemisphere. But not one of these things could possibly done, were figure or indeed any thing else than colour, the immediate object of vision.

52 Magnitude.

As we see distance and figure, so we see magnitude; and we see both in the same way that we see shame or anger in the looks of a man. The impression made upon the bottom of the eye by rays reflected from a large magnitude, must necessarily be different from the impression made by rays reflected from a magnitude that is less. This is self-evident: and since the impression *ab extra* is in some way or other the cause of that sensation, which is all of which we are originally conscious in vision, it is obvious that the sensation, like

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like every other effect, must correspond to the cause from which it proceeds. Being therefore conscious of different sensations; and having, at an earlier period than we distinctly remember, learned by experience to refer them to different magnitudes; no sooner is each sensation excited than it suggests the notion, or if you please the perception, of that magnitude with which it is connected. So completely is this association fixed in the mind, that when we look at a known object, its real magnitude appears to be as instantly observed as its colour, whilst we hardly attend at all to the particularity of the sensation by which the magnitude is suggested. It is indeed customary with writers on optics to distinguish between tangible and visible magnitude, as if any kind of magnitude were the immediate object of vision: but this is not so; for magnitude is something external, whereas the immediate object of vision is a mere sensation. What has introduced into science this mode of speaking is the following fact, that as we approach a distant object it appears to the eye larger and larger every step, and less and less as we recede from it; whereas the tangible magnitude of an object is always the same. The reason of this apparent change of magnitude to the eye, according to the distance at which any particular object is viewed, is, that from a near object rays of light fall in greater numbers and more diverging than from the same object viewed at a distance. This of course alters the nature of the visible sensation: each common sensation is in the mind closely linked with a particular notion of magnitude; and by the exercise of sight and touch we have learned from experience, that the particular sensation caused by diverging rays must be referred to a larger magnitude than that which is caused by parallel rays proceeding from the same distance.

53 Visible sensations a kind of natural language.

Upon the whole, then, we think ourselves intitled to conclude, that the proper and original objects of vision constitute an universal language of the Author of Nature, by which we are instructed how to regulate our actions, in order to attain those things that are necessary to the preservation and well-being of our bodies, as also to avoid whatever may be hurtful or destructive to them. It is principally by the information of this language that we are guided in all the transactions and concerns of life: And the manner in which it signifies and marks to us the objects which are at a distance, is similar to that of languages and signs of human appointment, which do not suggest the things signified by any likeness or identity of nature, but only by an habitual connection, which experience has made us to observe, between them. This language of the eye, like the language of the tongue, suggests by one sensation what may be resolved into a variety of perceptions. A tree is composed of a trunk, branches, leaves; it has colour, figure, size; and all these things are at once suggested to the mind by the two words *spreading oak*. Just so it is with respect to vision: the sensation received by the eye suggests at once the *trunk*, *branches*, *leaves*, *colour*, *figure*, and *size* of the oak, and suggests them all as the qualities of one object.

Chap. II. *Of* Retention *and* Ideas.

Retention and Ideas.

From the experiment with the burning coal mentioned in n° 33, it is apparent, that sensations excited through the eye, together with their corresponding perceptions, remain in the mind for a short time after the external exciting cause is removed. The same thing appears from another experiment which was first made by Sir Isaac Newton, and which every man may repeat for his own satisfaction. It is universally known*, that a proper mixture of the seven original colours, *red*, *yellow*, *green*, *blue*, &c. constitutes that uniform appearance which we call *white*. But when these colours are made to pass in a rapid consecution before the eye, they excite the very same perception as when they are properly mixed: which is a satisfactory proof that the impression made by each separate colour remains in the brain until a revolution of all the colours be completed; for nothing but the impression of all the colours at *once* can produce the sensation and perception of *white*. Indeed no person capable of paying the proper attention to these things, can keep his eye fixed upon a luminous object, and afterwards shut it, without experiencing that the sensation and perception remain for some time after the external object is shut out, and that they go off gradually till they leave behind them the mental appearance, which is properly called an *idea* of the object.

54 Sensations and perceptions remain for a very short time after the removal of their objects.

* Hartley on Man.

The same continuance of the sensation after the removal of its cause is equally observable in the sense of hearing: for every sound which we hear is reflected by the neighbouring bodies; and therefore consists in reality of a variety of sounds succeeding each other at different distances of time, according to the distances of the several reflecting bodies. Yet this causes no confusion or apparent complexity of sound, unless when the distance of the reflecting bodies is very considerable, as in spacious buildings.

With respect to the continuance of the sensation of touch, doubts have been started; but for these there is as little room as for doubting the continuance of the sensations of seeing and hearing. The continuance of heat after the heating body is removed, and of the smart of a wound after the instant of infliction, are proofs that every sensation of touch does not vanish with its cause. A man unused to the motion of a ship or a coach, after having been a day at sea or on the road, feels or imagines he feels the rolling of the ship or the jolting of the coach after he is in bed and actually at rest. Of these facts we know not what other account can be given, than that the agitation in the brain, which is the immediate cause of the sensation of touch, remains for some time after the external cause of the agitation is removed.

As to the senses of taste and smell, Dr Hartley seems to think that there is no clear and direct evidence for the continuance of their sensations after their proper objects are removed: but in this instance the ingenious author does not justice to his own theory. Let any man eat onions, garlic, or any other thing of a very pungent taste, and immediately wash his mouth with fresh water, so as that he may be sure no part of the sapid body remains on his tongue or palate. According to this doctrine, the taste of the onion or garlic should instantly vanish with its object; but the fact is otherwise. Whoever shall make the experiment, will find the sensation to remain a considerable time; not indeed in its original force, but weakened no more than what it must necessarily be by the introduction of

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of a new ſenſation excited by the water. It is more difficult to aſcertain the permanency of ſmell: but analogy inclines us to believe, that in this particular it reſembles the other ſenſes, though we know not how to direct the reader to an experiment which will give him abſolute conviction.

55 Hence we have that power or faculty called memory. * See An Eſſay on the Reduction of the Faculties of the Mind, by M. Schwab.

Whether the cauſe of theſe continued ſenſations, after the removal of their objects, be in the brain alone, in the mind alone conſidered as an immaterial being, or in both together, is of very little importance; becauſe, taking the mind and its internal organs as one *metaphyſical whole**, it matters not to our preſent inquiry, where this retentive power reſides, as long as it can be proved to exiſt within us: for it ſeems evident, that what has the faculty of retaining a ſenſation when no longer acted upon by the object which excited it, muſt alſo have a power to preſerve the veſtiges of that ſenſation even after the ſenſation itſelf ſhall be entirely obliterated. This is in fact the caſe with the mind. When an object which we have once perceived is moſt remote from our thoughts, we are certain that there is within us a capacity, diſpoſition, tendency, or power, by which a repreſentation of that object may be at any time revived and preſented to the intellect. Thus the ſame inherent power of the mind and its internal organs, which retains a ſenſation and perception in the abſence of the object by which they were excited, can alſo reproduce that perception, or bring into the view of the intellect ſomething exactly ſimilar to it. The reproduction will not indeed be ſo lively as the original perception when accompanied with its correſponding ſenſation, becauſe ſenſation and actual perception are effected by a double cauſe, the action of the external object upon the organ, nerves, and brain, and the correſponding energy of the mind or ſentient principle: whereas, in the reproduction, the mind ſeems to act ſolely by its own power, and certainly without the aſſiſtance of external objects. This reproductive power is commonly called *memory*. By many of the ancient philoſophers, and by *M. Schwab*, with one or two others among the moderns, it is called *imagination*. We do not chooſe either to revive antiquated modes of expreſſion, or to introduce innovations of our own; but as we cannot diſapprove of the ancient phraſeology, after the definitions which the reader will by and by find of *imagination*, *memory*, and *recollection*, as given by Mr Harris, we have prefixed to this chapter the general title of *retention* which comprehends them all.

56 The opinions of philoſophers reſpecting memory.

When one recals an object of ſight by the power of memory, it appears to him preciſely the ſame as in the original ſurvey, only leſs diſtinct, and with a conviction (which is perhaps the reſult of experience) that the real object is not immediately before him. How is an object recalled by the power of memory? Does the man endeavour to form in his mind a picture or repreſentative image of the object? Let us liſten to the anſwers given by different philoſophers to this queſtion.

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57 The Peripatetics and Platoniſts

The ſentiments of the Peripatetics, as expreſſed by *Alexander Aphrodiſienſis*, one of the earlieſt commentators on *Ariſtotle*, are thus tranſlated by Mr Harris in his Hermes.—" Now, what fancy or imagination is, we may explain as follows: We may conceive to be formed within us, from the operation of the ſenſes about ſenſible ſubjects, ſome impreſſion (as it were), or picture in our original ſenſorium, being a relict of that motion cauſed within us by the external object; a relict which, when the external object is no longer preſent, remains, and is ſtill preſerved, being as it were its image; and which, by being thus preſerved, becomes the cauſe of our having memory. Now ſuch a ſort of relict, and (as it were) impreſſion, they call *fancy* or *imagination* (E)." A paſſage from ALCINOUS *of the doctrines of Plato*, as rendered into Engliſh by Dr Reid †, ſhows, that in this theory, as in that of perception, the Platoniſts agreed with the Peripatetics. " When the form or type of things is imprinted on the mind by the organs of the ſenſes, and ſo imprinted as not to be deleted by time, but preſerved firm and laſting, its preſervation is called *memory*."

† Eſſays on the Intellectual Powers of Man.

Mr Harris, who was deeply read in the ancient philoſophy, and who conſidered the authority of Ariſtotle and Plato as ſuperſeding all reaſoning and all inquiry, after juſtly obſerving, that if the ſoul had no other faculties than the ſenſes it could never acquire the leaſt idea of *time*, thus expreſſes himſelf on the ſubject before us:—" But happily for us we are not deſerted here. We have, in the firſt place, a faculty called *imagination* or *fancy*; which, however as to its *energies* it may be ſubſequent to ſenſe, yet is truly prior to it both in *dignity* and *uſe*. This it is which *retains the fleeting forms of things*, when things themſelves are gone, and *all ſenſation* is at an end. That this faculty, however connected with ſenſe, is ſtill perfectly different, may be ſeen from hence. We have an *imagination* of things that are gone and extinct; but no ſuch things can be made objects of *ſenſation*. We have an eaſy command over the objects of our *imagination*, and can call them forth in almoſt what manner we pleaſe, but our *ſenſations* are neceſſary when their objects are preſent, nor can we control them but by removing either the objects or ourſelves. As wax would not be adequate to its buſineſs of ſignature, had it not a power to retain as well as receive; the ſame holds of the SOUL, with reſpect to *ſenſe* and *imagination*. SENSE is its *receptive* power; IMAGINATION its *retentive*. Had it ſenſe without imagination, it would not be as wax but as water; where, though all impreſſions may be inſtantly made, yet as ſoon as made they are entirely loſt. Thus then, from a view of the two powers taken together, we may call SENSE (if we pleaſe), *a kind of tranſient imagination*; and IMAGINATION, on the contrary, *a kind of permanent ſenſe*."

58 diſtinguiſh properly between imagination and memory, &c.

Great part of the office which is here given to imagination, is in common Engliſh attributed to memory; but between theſe two faculties, as well as between them and recollection, the author accurately di-

(E) The original is as follows: Τι τοινυν εστιν ἡ φαντασια ωδε αν γνωρισαιμεν δει νοιεν εν ημιν απο των ενεργειων των περι τα αισθητα, οιον τυπον τινα αναζωγραφημα εν τω πρωτω αισθητηριω, εγκαταλειμματι της υπο του αισθητου γινομενης κινησεως, ο και μηκετι του αισθημου παροντος, υπομενει τε και σωζεται, ον ωσπερ εικων τις αυτου, ο και τις μνημης ημιν σωζομενον αιτιον γινεται το τοιουτον εγκαταλειμμα, και τον τοιουτον ωσπερ τυπον, φαντασιαν καλουσιν. *Alex. Aphrod. de Anima*, p. 135. *Edit. Ald.*

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distinguishes thus:—"When we view some *relict* of sensation reposed within us, *without thinking of its rise*, or *referring it to any sensible object*, this is FANCY or IMAGINATION. When we view some such *relict*, and *refer it withal to that sensible object which in time past was its cause and original*, this is MEMORY. Lastly, the *road which leads to memory through a series of ideas however connected, whether rationally or casually*, this is recollection."

59 Objections to their theory.

Of this theory we shall only remark, that if we could understand the words *picture* and *form* in a metaphorical sense, as candor obliges us to understand Locke's *images* in the mind, the doctrine of *Alexander Aphrodisiensis* would be very little wide of the truth. Experience teaches us that memory as well as perception depends upon the state of the brain; and as it is undeniable, that when a man to day contemplates an object which he perceived yesterday, or at any former period, he has a view of it in all respects similar to the original perception, only fainter and less distinct, it is extremely probable, that an impression *ab extra*, which produces a sensation and perception, leaves behind it some *tendency* in the brain, to vibrate as in the actual sensation, and that this *tendency* is carried into *effect* by the internal energy of the mind itself. But in the Peripatetic philosophy, *pictures* and *forms* in the *sensorium* were considered as real things, and by no means as metaphorical expressions. This is evident from their being constantly compared to the impression of a seal upon wax and from their converting the *materia prima* from something, which can neither be seen nor felt, into visible and tangible body, of which we shall treat afterwards. Now it being certain that on a being immaterial, no corporeal *form* can be impressed, and repeated dissections having shown that no such forms are in fact impressed on the brain, this whole theory is at once overturned.

[59] Locke's doctrine concerning memory

Modern philosophers having denied that there are real *images* or *forms* in the mind during the immediate act of perception, cannot consistently with themselves admit such images in the act of retention, or when those things which were formerly objects of perception are recalled to the mind by the power of memory. Mr Locke's doctrine is, that "the mind retains these simple ideas which it first received from sensation or reflection, two ways: first, by keeping the idea, which is brought into it, for some time actually in view, which is called CONTEMPLATION: and secondly, by the power which we have to revive again in our minds those ideas, which, after imprinting, have disappeared, or have been, as it were, laid out of sight; as when we conceive heat or light, yellow or sweet, the object being removed. This (he says) is MEMORY; which is, as it were, the store-house of our ideas †.

† Essay, Book ii. chap. 10.

To explain this more fully, he immediately adds the following observation:—"But our ideas being nothing but actual perceptions in the mind, which cease to be any thing when there is no perception of them, this laying up of our ideas in the repository of the memory, signifies no more but this, that the mind has a power, in many cases, to revive perceptions which it has once had, with this additional perception annexed to them, that it has had them before. And in this sense it is, that our ideas are said to be in our memories, when indeed they are actually nowhere; but only there is an ability in the mind, when it will, to revive them again, and, as it were, paint them anew on itself, though some with more, some with less difficulty, some more lively and others more obscurely. And thus it is, by the assistance of this faculty, that we are said to have all those ideas in our understandings, which, though we do not actually contemplate them, yet we can bring in sight, and make appear again, and be the objects of our thoughts, without the help of those sensible qualities which first imprinted them there."

To attempt a defence of the accuracy of this language would be vain; but as the author's meaning is sufficiently obvious, his expressions may be easily and certainly corrected. Had Locke said—"But our ideas being nothing but scenes or appearances in the mind, which cease to be any thing when there is no perception of them, this laying up of our ideas in the repository of the memory signifies no more but this, that the mind has a power, in many cases, to revive scenes which it has once viewed, with this additional perception annexed to them, that it has viewed them before;" there would have been no room for the many petulant remarks which have been made upon the passage.

60 Objected to

But against this account of memory, a much heavier charge has been brought than that which regards the propriety of the language. It has been said, that the additional perception, which, according to Locke, attends the revival of our ideas by the power of memory, "would be a fallacious perception, if it led us to believe that we had them before, since they cannot have two beginnings of existence: nor can we believe them to have two beginnings of existence; we can only believe that we had formerly ideas or perceptions very like to them, though not identically the same." Let us examine this question somewhat narrowly: for if it be really true, that in the sense in which the word *same* is here used, we cannot twice contemplate the same idea, all confidence in memory would seem to be at an end.

61 The objection obviated.

Suppose a man to stand on some of the rising grounds about Edinburgh, the Calton-hill for instance, and from that eminence to view the glorious prospect of the coast of Fife, the ocean, the frith of Forth, and the little islands scattered in the frith. Let him go away, and return next day to the same place, and look the same way: we would ask whether he has the same *view* or *perception* which he had the day before? The man must surely be very captious who would say that he has not: and yet it is certain that the energy of mind by which he perceives on one day cannot be identically the same with that by which he perceived on another; nor are the rays of light which fall upon his eyes on the second day, identically the same with those which fell upon his eyes and occasioned vision on the first day. Let the same man now shut his eyes, and contemplate the various objects at which he had been just looking. They will appear to him in all respects the same as when viewed by means of his organs of sight, only fainter and less distinct, with this additional conviction, that the immediate objects of his present contemplation are not real external things, but *ideas* or *mental representations* of those things which had so lately been the objects of his sight. Let him think no more about the matter for some

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some days, and then exert his power of memory. We have no hesitation to say, that in the sense of the word *same*, as used by Mr Locke, the very same ideas will recur and be present to his intellect which were present to it at the former contemplation. The second energy of memory or imagination, or whatever it may be called, is not indeed identically the same with the first; nor is that agitation or motion, or whatever other affection of the brain is necessary to memory, identically the same at the second time as at the first: but the mind exerting itself in the very same manner at the one time as at the other, produces the same kind of agitation in the brain, and is itself affected in the very same way at the second as at the first exertion. Whence it follows, that the second *ideal scene* will be as much the same with the first, as the second *actual perception* is the same with the first; and the two ideal scenes, and the two actual perceptions, are respectively said to be the same with each other, only because they impress the mind with a conviction that they were occasioned by the same external objects.

But though we think Locke's doctrine, with respect to memory, may be thus easily vindicated from the charge of fallaciousness, we must acknowledge that to us it appears not to be of much value. It teaches nothing, but that the mind has a power to retain ideas of those objects which it formerly perceived, and in many instances to recal them as occasion may require. But these are truths known to all mankind, to the clown as well as to the philosopher.

62 The opinion of Hume.

Philosophers in general have paid less regard to the retentive faculties of the mind than to its original powers of perception. Perhaps they imagined, that as memory depends upon perception, and in some respects appears to resemble it, a competent knowledge of the nature of the former faculty would lead to that of the second. Be this as it may, Mr Hume, who was at some pains to detail his notions of perception, has in his Philosophical Essays only dropt concerning memory and imagination a few hints, so loosely thrown together, that, if he had not elsewhere expressed himself with more precision, it would have been difficult to discover his real meaning. According to him, that which is commonly called the *perception of an external object*, is nothing but a strong impression upon the mind; and that which is called the *remembrance of a past object*, is nothing but a present impression or idea weaker than the former. Imagination is an idea weaker than the idea or impression which he calls *memory*. This seems to be a wonderful abuse of language. Impressions are not perceptions; and, if possible, they can still less be called *ideas*, which are but secondary perceptions. It is likewise far from being true, that an idea of imagination has necessarily less vivacity than an idea of memory. We have seen Mr Hume, and have at the present moment an idea of his form and dress: we can likewise imagine to ourselves a centaur; and though a centaur was never seen, and therefore cannot be *an impression repeated by memory*, our idea of the monster is much more lively and distinct than that of the philosopher.

63 Of Dr Reid, Essays on the Intellectual Powers of Man.

Dr Reid having observed of memory *, that it is by it we have an immediate knowledge of things past; that it must have an object; that in this respect it agrees with perception, but differs from sensation, which has no object but the feeling itself; and that every man can distinguish the thing remembered from the remembrance of it—proceeds to inquire what memory is? And, "First (says he), I think it appears that memory is an original faculty given us by the Author of our being, of which we can give no account but that we are so made. The knowledge (continues he) which I have of things past by my memory, seems to me as unaccountable as an immediate knowledge would be of things to come (F); and I can give no reason why I should have the one and not the other, but that such is the will of my Maker. I find in my mind a distinct conception and a firm belief of a series of past events; but how this is produced I know not. I call it *memory*; but this is only giving a name to it; it is not an account of its cause. I believe most firmly what I distinctly remember; but I can give no reason of this belief. It is the inspiration of the Almighty which gives me this understanding. When I believe the truth of a mathematical axiom or of a mathematical proposition, I see that it must be so: every man who has the same conception of it sees the same. There is a necessary and an evident connection between the subject and the predicate of the proposition; and I have all the evidence to support my belief which I can possibly conceive. When I believe that I washed my hands and face this morning, there appears no necessity in the truth of the proposition. It might be or it might not be. A man may distinctly conceive it without believing it at all. How then do I come to believe it? I remember it distinctly. This is all I can say. This remembrance is an act of my mind. It is impossible that this act should be, if the event had not happened? I confess I do not see any necessary connection between the one and the other. If any man can show such a necessary connection, then I think that belief which we have of what we remember will be fairly accounted for: but if this cannot be done, that belief is unaccountable; and we can say no more but that it is the result of our constitution. Our original faculties are all unaccountable: Of these memory is one. He only who made them comprehends fully how they ar made, and how they produce in us not only a conception, but a firm belief and assurance, of things which it concerns us to know."

On this account of memory we shall make no remarks. There is a certain sense of the words, in which every thing which the author has said on the subject is undoubtedly just; and it would be very uncandid to take

(F) If memory depends upon the state of the brain as it has been affected in past perceptions, this appears to us a strange position. Perhaps the excellent author means nothing more, than that it is as unaccountable to us, that impressions on the brain should cause perception, and the vestiges of those impressions should cause remembrance, as how the mind might not perceive things to come without the intervention of impressions on the brain. If this be his meaning, no man will controvert it: for it is impossible to discover the nature of that relation which subsists between an impression and perception; but that there is such a relation, we know from experience.

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take his words in any other ſenſe. But though memory, as it is the reſult of that conſtitution which was given us by God, and not the offſpring of habit or human contrivance, is unqueſtionably an original faculty; and though it is therefore impoſſible to account for it ſo fully as to ſilence every inquiry which may be made; yet we could wiſh that Dr Reid had beſtowed a little more pains upon it, in order to diſcover if poſſible in what reſpects it reſembles or differs from perception. He has well obſerved, that there are laws of nature by which the operations of the mind are regulated, as well as laws of nature which govern the material ſyſtem. As the latter are the ultimate concluſions which the human faculties can reach in the philoſophy of bodies, ſo the former are the ultimate concluſions which we can reach in the philoſophy of minds. The more general that theſe laws are in both caſes, the more uſeful they are and the more ſatisfactory: for as they are themſelves inexplicable, the fewer they are in number, and the more comprehenſive each, the fewer will thoſe phenomena be for which we can give no account. Thus, as we know not what makes the planets tend to the centre of the ſun, or heavy bodies tend to the centre of the earth, we can give no other account of theſe phenomena, but that, as they appear to be of the ſame kind, it is reaſonable to conclude that they proceed from ſimilar cauſes. What the cauſe is of this tendency of bodies towards each other, we know not. We call it *gravitation*, and employ it to account for all phenomena of the ſame kind. In like manner it is univerſally allowed, that as we know not how mind and matter operate upon each other, there is ſomething in perception wholly unaccountable. That perception follows ſenſation; and that there is no ſenſation which is not occaſioned by ſome affection of the brain, proceeding from ſome impreſſion *ab extra*; we have the evidence of experience: but how a particular affection of the brain ſhould excite a ſenſation in the mind, we know not; though we may here, as in the corporeal ſyſtem, attribute ſimilar effects to the ſame or ſimilar cauſes. Thus, if when we exert an act of memory we have the ſame appearance of things as in the original act of perception, the rules of philoſophiſing authoriſe us to refer both phenomena to the ſame general law; juſt as they authoriſe us to refer the motion of the planets and of projectiles to the ſame general law. On the other hand, if we perceive no ſimilarity between memory and perception, we have made no progreſs in the philoſophy of mind; for in that caſe we have diſcovered two phenomena proceeding from two cauſes totally different from each other, and both inexplicable. Although we ſcarcely hope to throw any light upon a ſubject which Dr Reid has not attempted to illuſtrate, we ſhall ſtate a few facts reſpecting the memory, and ſubmit to the reader the concluſions to which we think theſe facts lead.

1. Objects once perceived by the ſenſes, when recalled to the mind by the power of memory, appear preciſely the ſame as in the original perception, only leſs diſtinct*. For example, having ſeen yeſterday a ſpreading oak growing on the bank of a river, and having heard a ſhepherd play, and handled a ſquare ſtone, we endeavour to recal to our minds theſe objects which are now abſent. How is this operation performed? Do we endeavour to form in our minds pictures of them or repreſentative images? or, does our intellect ſurvey the types or forms which, according to Ariſtotle, thoſe objects left in the imagination when originally perceived; Neither of theſe things is done. We conceive ourſelves as ſtanding in the ſame place where we ſtood yeſterday; upon which we have perceptions of the objects ſimilar in all reſpects to the perceptions which we had when we employed our eyes, our ears, and our hands. The tree appears, as it were, before us; faint indeed, but attended with all the objects which we obſerved around it yeſterday: we ſeem to hear the ſound of the pipe confuſedly, and at a diſtance; to move our hands over the ſtone, and to feel the ſame ſurfaces and the ſame angles which we felt in the original perception. In this recollection we are not conſcious of pictures or images more than in the original ſurvey. The perceptions ſeem to be of the tree and river themſelves, of the ſound itſelf, and of the ſtone itſelf, exactly as at the firſt; and yet we are ſatisfied that in the act of remembrance we perceive no ſuch object as a *real* tree, pipe, or ſtone. That theſe are facts, every man muſt be convinced who attends to the energies of his own mind when exerting the powers of retention: and therefore it is, in our opinion, with no impropriety that Mr Harris ſays, we may call SENSE, if we pleaſe, *a kind of tranſient imagination*; and IMAGINATION, on the contrary, *a kind of permanent ſenſe*: for if theſe two faculties, as far as the mind or intellect is concerned, be not the ſame, they ſeem to reſemble each other much.

64 The appearance of ſenſible objects when recalled by the power of memory.

* Appendix to Elements of Criticiſm.

2. The *primary* preception of a *viſible* object is more complete, lively, and diſtinct, and remains longer in the *ſenſorium*, than that of any other object. We know likewiſe by experience, that an *idea* or *ſecondary* perception of a viſible object is as much more complete, lively, and diſtinct, than the idea of any other object, as was the *primary* perception; and that we remember things which we have ſeen for a longer time than ſounds which we have heard, or than tangible objects which we have only handled. Yet there ſeems to be a conſtant decay of all our ideas, even of thoſe which are ſtruck (G) deepeſt and in minds the moſt retentive; ſo that if they be not frequently renewed by repeated exerciſe of the ſenſes, or by reflection on thoſe objects which at firſt occaſioned them, the print (G) wears out, and at laſt there remains nothing to be ſeen. Concerning ideas, it is eaſy to remark, that thoſe remain longeſt and cleareſt in the memory which are derived from two or more ſenſes, eſpecially if the ſenſe of ſight be one of the number, or which are oftneſt refreſhed by a return of the objects which produced them. Hence a man has a longer and more diſtinct remem-

65 What ideas remain longeſt in the memory.

(G) Theſe expreſſions, which mention ideas as things which are *deep ſtruck*, and as *prints which wear out*, are the expreſſions of Locke. We hope it is needleſs to warn our readers, that they are uſed by us as they were by him in a metaphorical ſenſe. On theſe ſubjects it is impoſſible to write without metaphor; which, while the meaning is obvious, no man will condemn, who reflects that the words of language were not invented by metaphyſicians, and are for the moſt part *literally* ſignificant only of ſenſible objects.

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remembrance of what he has seen than of what he has only heard, of what he has both seen and felt than of what he has only seen; and the ideas which we have of heat and cold, of hunger and thirst, and of all those things which most frequently affect our senses, are extremely clear, and are never quite lost whilst the mind retains any ideas at all.

66 Memory a kind of habit.

2. Memory appears to be a kind of habit, which is not always in exercise with regard to things we remember, but is ready to suggest them when there is occasion. The most perfect degree of this habit is when the thing presents itself to our remembrance spontaneously, and without labour, as often as there is occasion. A second degree is, when the thing is forgotten for a longer or shorter time, even when there is occasion to remember it, and yet at last some incident, such as a violent passion *, which agitates the whole mind and sensorium, tumbles the idea, as it were, out of its dark corner, and brings it into view without any search. A third degree is, when we cast about and search for what we would remember, and after some labour find it out. This searching faculty of the soul is by Aristotle called ἀναμνησις, by Dr Reid and others *reminiscence*, and by Mr Harris *recollection*. Should it be said, that what we *will* to remember we must already conceive, as we can will nothing of which we have not a conception; and that therefore, a *will* to remember a thing, seems to imply that we remember it already—we answer, with Dr Reid, that when we will to remember a thing, we must indeed remember something relating to it; but we may have no positive idea or conception of the thing itself, but only of the relation which it bears to that other thing which we do remember. Thus, one remembers that a friend charged him with a commission to be executed at such a place, but he has forgotten what the commission was. He applies himself to discover it; and *recollects* that it was given by *such a person*, upon *such an occasion*, in consequence of such a *conversation*: and thus by a train of thought he is led to the very thing which he had forgotten and wished to remember. To this operation it is not always necessary that the relations between the various ideas which the mind turns over be very close, or have their foundation in nature; for a casual connection is often sufficient. Thus, from seeing a garment, we think of its owner; thence of his habitation; thence of woods; thence of timber; thence of ships; thence of admirals; thence of cannons, iron, furnaces, and forges, &c."

* Reid's Essays on the Intellectual Powers of Man, Locke's Essay, &c. and Harris's Hermes.

67 In recollection one idea suggests another, and why.

That in the process of recollection, one idea should suggest another, may be easily accounted for. When, in perception, our minds are exposed to the influence of external objects, all the parts and properties, and even the accidental variable adjuncts of these objects, are perceived by full-grown men at the same time; so that the whole group makes but one impression upon our organs of sense, and consequently upon the mind. By these means all the parts of the simultaneous impression †, and consequently of the perception occasioned by that impression, are so intimately associated or linked together, that the idea of any one of them recurring at any future period generally introduces the ideas of all the rest. But as the necessary parts and properties of any thing are more closely linked together, and occur more frequently than any particular variable adjuncts, it is obvious, that by the idea of any one of these properties, the idea of the rest, and of the object itself, will be more readily introduced than by the idea of any variable adjunct. It seems, however, to be certain, that we have no power of calling up any idea at pleasure, but only such as have a connection, either in nature or by means of former associations, with those that are at any time present to the mind. Thus the sight, or the idea, of any particular person, generally enables us to recollect his name, because his name and his person have been constantly associated together. If that fail to introduce the name, we are at a loss and cannot recollect it at all till some other associated circumstance helps us. In naming a number of words in a sentence, or lines in a poem, the end of each preceding word or line being connected with the beginning of the word or line which succeeds it, we can easily repeat them in that order; but we are not able to repeat them backwards with any ease, nor at all till after many fruitless efforts. By frequent trials, however, we acquire at last a facility in doing it, as may be found by making the experiment on the names of number from one to twenty. It is, indeed, probable, that in the wildest flights of *fancy*, no single idea occurs to us but such as had a connection with some other idea, perception, or notion, previously existing in the mind, as shall be shewn more fully in a subsequent chapter.

† Hartley on Man.

68 Memory depends on the state of the brain.

4. "Memory appears to depend entirely or chiefly upon the state of the brain *. For diseases, concussions of the brain, spirituous liquors, and some poisons, impair or destroy it; and it generally returns again with the return of health, from the use of proper medicines and methods. It is observable, too, that in recovering from concussions and other disorders of the brain, it is usual for the persons to recover the power of remembring the then present common incidents for minutes, hours, and days, by degrees; also the power of recalling the events of his life preceding his illness. At length he recovers this last power perfectly; and at the same time forgets almost all that past in his illness, even those things which at first he remembered for a day or two. Now the reason of this seems to be, that upon a perfect recovery the brain recovers its natural state, and all its former affections and tendencies; but that such affections or tendencies as took place during the preternatural state, *i. e.* during the patient's illness, are obliterated by the return of the natural state." All this we are induced to believe; because, though it is a fact incontrovertible, that in certain diseases the memory is impaired, and recovers its vigour with the return of health, it is not conceivable that the mind itself should suffer any change by diseases, concussions, or spirituous liquors, &c.

* Hartley on Man.

From these facts we are strongly inclined to conclude, that the power of the *mind* or *immaterial* (H) *principle*

(H) Through the whole of this and the preceding chapters, we have taken it for granted that the sentient principle in man is not material. This is the *common*, and, as shall be shown afterwards, the most *probable* opinion; but whether it be absolutely certain or not, makes no difference on the theories of sensation and perception. These are obviously neither figure nor motion, and therefore not subject to the laws which govern the material world.

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ciple, by which it remembers past events, differs not from that by which it perceives present objects. In perception, impressions are made upon the organs of sense, which are communicated to the brain; and, by some unknown means, occasion sensations which are followed by the perception of the external object. When by the power of memory we recal past objects of sense, the mind has the same view of them as in the original perception, except that they appear fainter, less distinct, and generally more distant. We have, therefore, reason to conclude, that in the act of remembrance the brain is affected in the same way, though not so forcibly, as in perception. That memory depends as much as perception upon the state of the brain, is confirmed by daily experience; and therefore there cannot be a doubt but that external objects, operating upon the senses, nerves, and brain, leave some permanent effect behind them. What that effect precisely is we cannot know, and we need not desire to know; but that they leave *some* effect we have as good evidence as that the planets are moved round the sun by forces of the same kind with those by which projectiles are moved on the earth. Could we suppose that they leave real *prints* or *impressions* behind them, which we confess to be very little probable, memory would seem to be nothing but the perceptive power of the mind turned to those impressions. If the permanent effect of impressions by external objects be, as Dr Hartley supposes, only a tendency in the brain to vibrate as in the original perception, remembrance will result from the mind's operating upon the brain as in actual perception; and the reason that ideas of memory are fainter than perceptions of sense, is, that the former are produced by a single, and the latter by a double, operation.

69 External objects operating on the senses leave some permanent effect in the brain.

70 Why the memory advances to perfection, and then gradually decays.

This theory appears to be greatly confirmed by the following well-known facts, that children soon commit to their memory any thing which they understand, and as soon forget it; that the powers of memory gradually advance to perfection, and then gradually decay; and that old men remember more distinctly what they perceived in their youth, than what they perceived a year ago. For if the memory belonged wholly to the pure intellect, and had no dependence upon the brain, it is not easy to conceive how it should advance towards a state of perfection and afterwards decay. A being which is unextended and indivisible, can suffer no change either in its essence or in its faculties: the ideas which it had once retained, it would retain forever. But if memory be occasioned by some relict of sense left in the brain, it is easy to see how all those changes should take place: and therefore, though we have the weight of Dr Reid's authority against us, we cannot help thinking that Aristotle was in the right, when he imputed the shortness of memory in children to this cause, that their brain is too moist and soft to retain impressions made upon it; and that he was likewise in the right, when he imputed the defect of memory in old men to the hardness and rigidity of the brain, which hinders it from receiving any durable impression.

Another argument to prove, that in remembrance the mind acts upon something left in the brain by the impressions of sense, is this, that nothing can act but where it is present. The truth of this axiom is acknowledged by Dr Reid, and we believe by all mankind except Dr Priestley and one or two others, whose paradoxes we shall consider afterwards. Now it is confessed, that in recollection at least the mind is active; and therefore it must act, *not* upon an object which has now perhaps no existence, and certainly no immediate existence, *but* upon something left by that object in the brain or sensorium, to which the mind is intimately present.

71 By what means we never confound memory with perception.

But if this be so, we may be asked how it comes to pass that men never confound memory with perception, nor fancy that they perceive things which they only remember? If perception be an inference drawn from certain sensations excited by an impression on the brain, and if remembrance result from the mind's operating upon relicts of those impressions, one would think it natural to suppose, that in both cases we have actual perceptions, though in the one case the perception must be more vivid and distinct than in the other. To this we answer, That previous to all experience, perception and memory are very probably confounded; and that we believe a man brought into the world with all his faculties in their full *natural* perfection, would not instantly be able to distinguish what he remembered from what he perceived. This we know to be the case with respect to imagination, a faculty which strongly resembles memory; for in dreams, and sometimes even in waking reveries, we fancy that we actually perceive things which it is certain we can only imagine. A very short experience, however, would enable this newly created man to make the proper distinction between remembrance and perception. For let us suppose him to be brought into a dark room, and soon afterwards a candle to be introduced. The candle would give him a visible sensation, though not at first the perception of an external object. Let the candle after some time be carried out: the man would retain a visible *idea*, which he might confound with the actual sensation. But if, whilst this idea remained in his mind, the candle were brought back, he would instantly feel a difference between the real sensation and the idea, when both were together present to his mind. And having, in some such manner as we have already described, acquired the power of perceiving external objects by means of his senses, he would soon discover, without any effort of his own, the difference between actual perceptions and the ideas treasured up in his memory.

92 The order of succession in which objects recur to the memory.

The only remaining difficulty which seems to encumber this theory of remembrance, is, to account for the order of succession in which objects recur to the memory, and to which we give the name of *time*.— But this difficulty will vanish when we have ascertained what *time* is. At present it is sufficient to observe, that our perceptions of external objects remain a certain space of time in the mind; that this time is different, according to the strength and other circumstances of the impression which occasioned the perception; and that traces of those perceptions *i. e. ideas*, may be recalled after the intervention of other trains of ideas, and at very different intervals. If one look upon a house, and then shut his eyes, the impression which it made upon his mind will not instantly vanish:

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nish: he can contemplate the house almost as long as he pleases; and, by the help of various associated circumstances, he may recal the idea several years afterwards and refer it to the original perception.

73 Brutes have memory, and

Before we dismiss the subject of retention, it may not be improper to take notice of the retentive powers of inferior animals. Aristotle, Locke, Dr Reid, and almost every philosopher of eminence both among the ancients and moderns, have maintained, that inferior animals have memory as well as men; and indeed we do not perceive how the fact can be denied of the more perfect animals, and those with whose operations we are best acquainted. A dog knows his master again after a long absence; a horse will trace back a road which he has but once travelled, often with more accuracy than his rider; and it is well known that many species of singing birds have a capacity to learn tunes from the human voice, and that they repeat the notes again and again, approaching nearer and nearer to perfection, till at last they sing the tune correctly. These phenomena can be accounted for only by supposing, that in the brains of the several animals traces are left by perception, of the same kind with those which perception leaves in the brain of man and which are the cause or occasion of his remembrance. With respect to this point, the learned author of *Ancient Metaphysics* differs from his master Aristotle. He allows that brutes have imagination, but denies that they have memory: for (says he) "memory necessarily implies a sense of *time*, and what is *first* and *last*; but brutes have no idea of time, or of first and last; and it is certain that they have not consciousness or reflection, by which only they could review their own operations. At the same time he admits, that imagination in the brute serves the purpose of memory in us; for whenever he sees the object that is painted on his *phantasia*, he knows it again, but without any perception of the time when he first saw it." But that a brute, when he sees the object which is painted on his phantasia, should know it *again* without referring it to a former perception, is plainly impossible. The recognisance of any thing consists in a consciousness of its having been perceived before; and nothing more than such recognisance is essential to memory. The author's mistake seems to lie in supposing that memory necessarily implies a sense of some determinate portion of past time; but we surely remember many things of which we can only say that we have formerly perceived them, without being able to ascertain the precise period at which we had such perceptions. A child has the use of memory sooner than he acquires the faculty of speech; but he must have spoken and even reasoned before he can have an accurate notion of time, which, as shall be shown afterwards, arises from comparing the fleeting succession of our own ideas with the permanence of ourselves and other objects. The author's distinction between memory and imagination seems to be on all accounts improper. Aristotle has said, and said truly, that there is memory of *ideas* as well as of sensible objects; meaning by ideas general conceptions or propositions: but this reviver of his philosophy is inclined to say, "that *memory* is only of *ideas*, consequently belongs only to man; and that *imagination* is only of sensible objects, and consequently belongs both to man and brute."—But surely man *remembers* what he has *seen* and *felt* as well as what he has *conceived* or *thought*; and if imagination and memory be properly distinguished by Mr Harris, the reverse of this writer's doctrine must be true, viz. that imagination belongs only to *man*, and memory of sensible objects both to *man* and *brute*.—We can contemplate in imagination the idea of a *centaur* or a *golden mountain*; but we cannot be said to remember them, for they were never perceived. That a dog can contemplate in his imagination the idea of a *centaur* or of a *golden mountain*, we have not the least reason to suppose: but were he not capable of viewing relicts of sense reposed within him, and referring them to their original causes, he could not possibly recognise his master after a day's absence.

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74 the power of recollection.

Dr Reid and the same author agree with Aristotle, in thinking it probable that brutes have not reminiscence, or the power of recollection: but there are many well attested facts which seem to prove the contrary. We shall mention one which fell under our own observation. One of the persons concerned in this work was, when a young man, absent for five months from the house of his father. Upon his return, a dog of that species which is commonly called the *shepherd's cur*, and which had been in the possession of his father only a few months before his departure, gazed at him for a few minutes as at any other stranger. The animal then began to walk round him with looks which soon attracted his notice. This made him call the dog by the name which he bore in the family, and stretch out his hand to caress him, when the creature instantly leaped upon him with all that appearance of attachment which those animals so commonly exhibit upon the return of their master after a few days absence. If this was not recollection, we should be glad to know what it was, for we cannot distinguish it from recollection in men. Indeed, if dogs and some other animals possess, as Aristotle, Locke, and others, allow them to possess, the power of memory and something of ratiocination; and if as Dr Reid expressly says *, "they expect events in the same order and succession in which they happened before;" it is not conceivable that they can be wholly destitute of reminiscence, or the power of recollection.

* Essays on the Intellectual Powers of Man.

75 Memory capable of improvement.

That memory is a faculty of the first importance, cannot be denied; since it is obvious, that, without the power of retaining the ideas and notions which we receive by the senses and other faculties, we never could make any progress in the acquisition of knowledge, but should begin every day, nay every hour, in the same state of ignorance in which we were born. That it is a faculty capable of improvement by exercise, and that there are some methods of exercise better adapted for this purpose than others, has been shown elsewhere. See MEMORY.

CHAP. III. *Of* SIMPLE APPREHENSION *and* CONCEPTION.

76 Ideas of sensation the first materials of human knowledge.

THE ideas received into the mind by the senses, and treasured up in the memory and imagination, are the original materials of human knowledge. It is by comparing those ideas with one another, or by analysing them into their first principles, that we acquire all our knowledge in mathematics and philosophy, and

and indeed all the knowledge which regulates our conduct through life. It must, therefore, be of importance to trace the progress of the mind in her various operations upon these materials; beginning as she certainly begins, with that which is most simple, and proceeding regularly to those which are more complex and difficult.

77 Simple apprehension of ideas

Now the first operation of the mind about her ideas appears plainly to be that which logicians term *simple apprehension*. Having yesterday observed a *tree* or any other object, if we contemplate the idea of that tree to day as it remains in the imagination, without comparing it with any other idea, or referring it to any external object, we perform the operation which is called *simple apprehension*. We consider simple apprehension as an *operation*, because the mind in the apprehension of her own ideas is certainly active; she turns them, as it were, round and round, and views them on every side.

78 Different from conception.

Simple apprehension is a phrase which is commonly taken to be of the same import with the word *conception*; and in the ordinary affairs of life no confusion can arise from an indiscrimate use of the two words: but in this article we think it expedient to employ the phrase *simple apprehension*, to denote the view or contemplation of those ideas only which the mind by sensation has actually received from external objects; and the word *conception* to denote the view, not only of those ideas, but also of such as the mind fabricates to herself. Thus, a man may *conceive* a centaur, but we would not choose to say that he may *apprehend* a centaur: not that there is any impropriety, perhaps, in this last expression; but as there is certainly a difference between *apprehending* the idea of what has been seen or felt, and *conceiving* that which never existed, perspicuity requires that these different operations be expressed by different names.

79 In what sense it is true that we can conceive objects which never existed.

We have said that the mind may conceive what never existed; and every man may easily satisfy himself that what we have said is true: but though this has been frequently called the creative power of the mind, it has in fact no resemblance to *creation*. The materials of all our most complex and fantastic conceptions are furnished to our hands by sensation and reflection; nor can we form one simple idea which was not originally received by some of our senses from external objects, or, as shall be shown afterwards, one intellectual notion which was not acquired by reflecting on the operations of our own minds. To explain the process of fantastic conception, it is to be observed, that in every sensible object we perceive at once several things, such as *colour*, *figure*, *extension*, and *motion* or *rest*, &c. These are the objects of different senses: but they are not, at least, by full grown men, perceived in succession, but all at once; whence it comes to pass that the memory, or the imagination, retains not several distinct and disjointed ideas, but the idea of *one coloured*, *figured*, and *extended object*. But when we compare various objects, or the ideas of various objects, together, we find that in some respects they agree and in others disagree; *i. e.* that several objects affect some of our senses in the same way, and other senses differently. Thus one globe is black, and another white; one black substance is circular and hard, and another square and soft. In the first instance, the two globes affect our sense of touch in the same way, and our sense of seeing differently; in the second, the two black substances affect our sense of sight in the same way, and our sense of touch differently.

From observing this difference among objects by means of the different sensations received from them, the mind learns to analyse its original ideas, which are copies of those sensations, into their first principles, and to combine those principles in such a manner as to form complex ideas of objects which we never actually perceived by the senses. Of the simple and unmixed principles which compose those complex ideas, there is not indeed one which was not originally received by some sense; so that the whole difference between complex ideas fabricated by the mind, and those which are the relicts of sensation, consists in the order in which the constituent simple ideas of each are put together. Thus, no man ever saw a mountain of pure gold; and therefore the idea of such a mountain can be in no human mind as a relict of sensation: but we have all seen pieces of gold of different sizes, and we have all seen mountains; and nothing is more easy than to *conceive* a piece of gold extended on all sides to the size of a mountain, and rising out of the earth. Again, though no person ever saw a centaur, yet it is easy to *conceive* the upper parts of a man joined to the breast and shoulders of a horse. In these instances, the complex conceptions are of things which it is in the highest degree probable never had a real existence, and which it is certain we never *perceived* as existing: but the simple ideas of which they are composed are the relicts of actual sensations; for every one has perceived as really existing the body of a horse and the upper parts of a man, and when conceiving a centaur he only perceives them to exist united. That we have not in the imagination one simple and unmixed idea which was not left there as a relict of sense, every man will be convinced who shall try to conceive a simple colour or taste which is totally different from all the colours and tastes, and all the shades and varieties of them, which he has received by sensation; but his simple ideas, though all received from without, he may put together in numberless manners, differing from any order in which he has ever actually perceived the qualities of external objects existing.

80 This power of exception limited to possible existence.

Yet even this power of the mind is limited. It is impossible to put together a number of *contrary* and *inconsistent* ideas, in such a manner as to form of them one complex conception. No man, for instance, can conceive a thing to be at once white and black, round and square, hard and soft, in motion and at rest.— Hence it is a maxim among philosophers almost universally received, that though we can conceive many things which never *actually* existed, yet we can form no ideas but of such things as *might possibly exist*. A centaur never existed, but it may be conceived; for it is by no means impossible that the head of a man might be joined to the body of a horse; but black snow cannot be *conceived*; for in the complex idea denoted by the word *snow* whiteness is an essential part, and nothing can be conceived to be both black and white at the same time. From this undoubted fact, that we cannot conceive impossible existence, the power of conception has by some writers in certain instances been made a test of truth. "In every idea is implied (says

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(says Dr Price *) the possibility of the existence of its object; nothing being clearer, than that there can be no ideas of an impossibility, or conception of what cannot exist." "It is an established maxim in metaphysics (says Hume), that whatever the mind conceives, includes the idea of possible existence; or, in other words that nothing we imagine is absolutely impossible ‡." In a word, it has been admitted by all philosophers, from Pythagoras to Dr Reid, to be an axiom as evident and undeniable as any in Euclid, that whatever we can distinctly conceive is possible, though many things may be possible, nay, may really exist, of which we can form no conception.

* Review of the principal Questions and Difficulties in Morals.

‡ Essays.

81 The singular opinion of Dr Reid respecting our power of conception

This axiom has been denied by the author of the Essays on the Intellectual Powers of Man; who affirms, that "any two sides of a triangle may be conceived to be equal to the third," as distinctly as "any two sides of a triangle may be conceived to be greater than the third." This assertion from such a man surprised us as much as any paradox which we ever read: for nothing is more certain, than that *we* ourselves can form no conception of a triangle of which two of the sides are only equal to the third. We can, indeed, resolve the proposition into its different parts, and form the distinct and independent ideas of a *triangle*, *two sides*, and *one side*; and we can likewise form the general notion of *equality*: but to combine these ideas and this notion into one individual complex conception, we find to be absolutely impossible. A man who knows nothing of triangles, if such a man there be, might *believe* Dr Reid that it is a figure of which one of its sides is equal to the other two; but such a person would have no *conception* of the *figure itself*, but only a confidence in the Doctor's veracity.

82 controverted.

What is it to *conceive* a corporeal thing to exist? Is it not to fancy that we view it on all sides, as what may be seen, or felt, or smelt, or tasted? The Doctor, indeed, repeatedly reprobates as the source of much error the notion of ideas as images in the mind; and if ideas be taken as real material figures, he is certainly in the right: But we appeal to the common sense of mankind, whether every person who distinctly *conceives a triangle*, is not at the time conscious that his mind is affected in a manner similar, though not so forcibly, as when he actually views a triangle with his eyes? What other men may feel, they know best; but we are as certain that this is the case with respect to ourselves, as we are certain of our own existence. That this affection of the mind is occasioned by some agitation in the brain, of the same kind with that which occasions actual perception, is highly probable; but whatever be the cause, the fact is undeniable.

The Doctor's words indeed, taken by themselves, would lead one to think, that by *conception* he means in this case nothing more than the understanding of the terms of a proposition: but if that be his meaning, there was no room for controversy; as the great philosophers *Cudworth*, *Clarke*, *Price*, and *Hume*, whose opinion he is combating, would have been as ready as himself to allow, that when a man is thoroughly master of any language, he will find no difficulty in understanding the meaning of any particular words in that language, however absurdly these words may be put together. When Dr Price says, that "in every idea is implied the possibility of the existence of its object, nothing being clearer than that there can be no idea of impossibility or conception of what cannot exist," his meaning evidently is, that we cannot mentally contemplate or fancy ourselves viewing any thing corporeal, which we might not actually view with our eyes, or perceive by some other sense (1). This is the true meaning of *conception*, which is something very different from understanding the separate meaning of each word in a proposition.

The learned professor, however, appeals to the practice of mathematicians for the truth of his opinion: and if they be on his side we must give up the cause; for in no science have we such clear ideas, or such absolute certainty, as in mathematical reasonings. But it is to be observed, that the word *conception* is with no propriety applied to *abstract truth*, but to *real* or *possible* existence; nor can we be said to conceive distinctly a *real* or *possible* object, unless we be able to turn it round and round, and view it on all sides.—The faculties which are conversant about *abstract truth* are the judgment and the reason; and truth itself consists in the agreement, as falsehood does in the disagreement, of two or more ideas or terms compared together. If those ideas about which the judgment is to be made can be immediately brought together, without the intervention of a third idea, it is impossible that we should *judge*, or, if Dr Reid will have it so, *conceive* that to be *true* which is *really false*. If the two ideas cannot be immediately brought together, it is impossible that we should form any *judgment* or *conception* at all about their *agreement* or *disagreement*: but we may *suppose* or *admit*, for the sake of argument, that they agree or disagree; and if that supposition conduct to a manifest absurdity, we then *know* that the supposition was false. It is, therefore, perfectly agreeable to the

(1) Dr Price may be thought by some to have contradicted in this passage what he had asserted in a former. He is a strenuous advocate for abstract and general ideas even of material objects: but those among the moderns who contend the most zealously for these, contend for them only as conceptions of the mind which can have no possible existence out of it. Were this likewise the opinion of Dr Price, he would certainly have fallen into a direct contradiction; but this is not his opinion. His notion of abstract ideas seems to be the same with that of Plato, who considers ideas, not only as the possibilities of existence, but as things actually existing from eternity, uncreated and independent even of the Supreme Mind. That Dr Price carries the matter thus far, we are unwilling to believe; but he certainly considers general ideas as real existences independent of *our* minds, though the immediate objects of our understanding. That in this notion he is mistaken, we shall endeavour to prove in the next chapter. It is enough for our present purpose to have shown that he does not contradict himself; and that he might with great propriety affirm on his own principles, as well as upon the principles of those who admit not of universal ideas, that in every idea is implied the possibility of its object.

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the maxim of Price and Hume, that mathematicians ſhould in many caſes prove ſome things to be poſſible and others impoſſible, which without demonſtration would not have been believed; becauſe if the ideas compared cannot be immediately brought together, no *judgment* previous to the demonſtration can be formed of the truth or falſehood of the propoſition; and if it concern not real or poſſible exiſtence, it is a propoſition with which *conception* has nothing to do.

"But (ſays Dr Reid) it is eaſy to *conceive*, that, in the infinite ſeries of numbers and intermediate fractions, ſome one number integral or fractional may bear the ſame ratio to another as the ſide of a ſquare bears to its diagonal." We are ſo far from thinking this an eaſy matter, that if the word *conceive* be taken in the ſenſe in which it is uſed by the philoſophers whoſe opinion he is combating, we muſt confeſs that we can form no adequate conception at all of an infinite ſeries. When we make the trial, we can only bring ourſelves to *conceive* the real numerical figures 1, 2, 3, &c. or the fractional parts $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, &c.; and even here our *conception* reaches but a ſmall way.—We have reaſon to believe, that minds of a larger graſp can conceive at once more of the ſeries than we can; and that the Supreme Mind conceives the whole of it, if the whole of a mathematical infinity be not a contradiction in terms: but ſurely no man will ſay that he can conceive an infinite ſeries as he conceives a centaur, and have an adequate and diſtinct view of it at once. If, by conceiving that in an infinite ſeries ſome one number may bear the ſame ratio to another that the ſide of a ſquare bears to its diagonal, the Doctor only means that ſuch a *ſuppoſition* may be made, his obſervation is not to the purpoſe for which it is brought; for the queſtion is not about our power to make ſuppoſitions of this kind, but about our power to raiſe in our imaginations an adequate and diſtinct mental view of poſſible or impoſſible exiſtence. "To ſuppoſe (ſays Johnſon), is to advance by way of argument or illuſtration, without maintaining the truth of the poſition." In this ſenſe a man may *ſuppoſe* that in an infinite ſeries there may be ſome one number which bears the ſame ratio to another that the ſide of a ſquare bears to its diagonal: but ſuch a ſuppoſition contains in it nothing that is *poſitive*, which conception always does; it is only admitting, for the ſake of argument, a poſition, of the truth or falſehood of which the perſon who makes the ſuppoſition knows nothing.—He is only talking of ratios as a blind man may talk of colours. A man born blind may be made to comprehend many of the laws of optics, and may make ſuppoſitions about colours, and reaſon from ſuch ſuppoſitions to a certain extent, as clearly and juſtly as one who ſees; but will any perſon ſay that a man blind from his birth can conceive *red* or *green*? It is much the ſame with reſpect to an infinite ſeries. We can follow ſuch a ſeries ſo far, and may know the ratio by which it increaſes or decreaſes, and reaſon from what we know with the utmoſt certainty: but no man ever *conceived the whole of an infinite ſeries* as he conceives an individual object; nor can any reaſonings upon the nature of it be applied to the queſtion of conceiving impoſſible exiſtence.

But "mathematicians often require us (ſays Dr Reid) to conceive things that are impoſſible, in order to prove them to be ſo. This is the caſe in all their demonſtrations *ad abſurdum*. Conceive (ſays Euclid) a right line drawn from one point of the circumference of a circle to another, to fall without the circle. I conceive this, I reaſon from it, until I come to a conſequence that is manifeſtly abſurd, and from thence conclude that the thing which I conceived is impoſſible." If it be indeed true, that Euclid deſires his readers to conceive a mathematical circle with a line drawn from one point of its circumference to another, and that line lying without the circle—if he really deſires them to form ſuch a complex conception as this, we have no heſitation to affirm, that he requires them to do what is manifeſtly impoſſible. The writer of this article has not in his cuſtody any copy of the elements in the original Greek, and therefore cannot ſay with certainty what are Euclid's words, nor is it of much importance what they be; for on a queſtion which every man may decide for himſelf, by looking into his own mind, the authority of Euclid is nothing.—The propoſition to which the Doctor refers, is the ſecond of the third book; and, in the edition of Simpſon is expreſſed thus: "If any two points be taken in the circumference of a circle, the ſtraight line which joins them ſhall fall within the circle." Every mathematician who can form an adequate conception of a circle and a ſtraight line, perceives the truth of this propoſition inſtantly, for it reſults neceſſarily from his conception; but he who has not an adequate conception of a circle, *may* ſtand in need of a demonſtration to ſhow him the truth: for it is to be obſerved, that demonſtration does not *make truth*; it only points it out to thoſe who cannot perceive it intuitively, juſt as a microſcope does not make the hairs on a mite's back, but only brings them within the field of viſion.

Were a man who never examined a mite through a microſcope, and who has no adequate ideas of the inſect kingdom, to be aſked whether there be hairs on a mite's back? he would probably anſwer that he did not know, but he could *conceive* no ſuch hairs. In like manner, were a man who has no adequate conception of a mathematical circle, to be aſked whether a ſtraight line, which joins any two contiguous points in the circumference, could lie *without* the circle? he would probably anſwer that he did not know. Now it is to be remembered, that the reader of the Elements can have no very adequate conception of a circle when he comes to the ſecond propoſition of the third book. The definition of a circle was indeed given him in the introduction to the firſt book: but of that definition he has hitherto had occaſion to make very little uſe, ſo that his idea of a circle will be little more accurate than that of an illiterate clown, who has no other idea of the figure than what he takes from a half-penny or a ſhilling. Dr Reid himſelf has elſewhere † well obſerved, that "when a youth of moderate parts begins to ſtudy Euclid, every thing at firſt is new to him. His apprehenſion is unſteady; his judgment is feeble; and reſts partly upon the evidence of the thing, and partly upon the authority of his teacher: but every time he goes over the definitions, the axioms, the elementary propoſitions, more light breaks in upon him; the language becomes familiar, and conveys clear and ſteady conceptions." In this ſtate he certainly

† See Lord Kames's Sketches of the Hiſtory of Man; Appendix to the firſt Sketch on the Sciences.

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tainly is when he reads for the first time the second proposition of the third book: his conception of a circle can then be neither clear nor steady. Our young geometrician however, must allow, that the proposition is either true or false; and if he has read the preceding books with any advantage, he must have clear and steady conceptions of angles and triangles, and be able to demonstrate many of their properties. "Well (says Euclid), though you have no adequate conception of a circle, you are well acquainted with plane angles and triangles, and many of their properties: let us suppose, if that be possible, that my proposition is false, and I will shew you that the supposition is absolutely inconsistent with what you know to be demonstrable or self-evident truth." This is all which Euclid can be supposed to require, when in the words of his excellent translator, he says, "If it (viz. the straight line) do not fall within (the circle), let it fall, if possible, without." He could not possibly desire a man who has an adequate idea of a circle, to form the positive and complex conception of that figure, with a straight line touching two points of the circumference, and yet lying on the outside of the circumference; because all his figures and lines are mere conceptions, and not real material things; and such a request would have been the same thing as if he had said, Conceive what cannot be conceived (K).

We have insisted the longer on this point, because we think it of the highest importance: for were it indeed true, that we could conceive impossible existence, the consequences would be very melancholy. These consequences it is needless to enumerate. Our readers will perceive, that if we could put together inconsistent ideas of sensible objects, and view them so united as one consistent whole, nothing is clearer than that our faculties would be contrived to deceive us, and we would be doomed to cheerless and universal scepticism.

Chap. IV. *Of* Abstraction *and* General Ideas.

83 Every sensible object and every idea are individual.

Every sensible object is an individual, and differs in many respects from every other object. As such it is perceived by the senses; and ideas being nothing more than relicts of sensation preserved in the imagination or memory, every idea must of course be an individual, as much as the object to which it refers. But all science, whether mathematical, moral, or metaphysical, is conversant about general truths; and if truth consists, as we have already observed, and shall more fully evince afterwards, in the agreement or coincidence of ideas, how, it may be asked, can general truth result from the comparison of general ideas? To get rid of this difficulty, many philosophers, both ancient and modern, pretend that the mind is furnished with *general ideas*, from a comparison of which result general propositions applicable to many individuals. Philosophers, indeed, have differed in opinion respecting the source of those ideas; some of the ancients deriving them immediately from the supreme mind to the human, whilst almost all the moderns say that they are framed by abstraction, and therefore call them *abstract ideas*.

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84 The doctrine of abstract ideas stated, and

The doctrine of *abstract* ideas has been so fairly stated, and in our opinion, so completely overturned, by Bishop Berkeley, that we shall content ourselves with abridging what he has said on the subject, and obviating some cavils which have lately been urged against his reasoning. "It is agreed on all hands (says that learned and ingenious prelate †), that the qualities or modes of things do never really exist each of them apart by itself and separated from all others; but are mixed, as it were, and blended together, several in the same object. But, we are told, the mind being able to consider each quality singly, or abstracted from those other qualities with which it is united, does by that means frame to itself abstract ideas. For example: There is perceived by sight an object extended, coloured, and moved: this mixed or compound idea, the mind resolving into its simple constituent parts, and viewing each by itself exclusive of the rest, does frame the abstract ideas of extension, colour, and motion. Not that it is possible for colour or motion to exist without extension; but only that the mind can frame to itself by *abstraction* the idea of colour exclusive of extension, and of motion exclusive of both colour and extension. Again, the mind having observed that in the particular extensions perceived by sense, there is something common and alike in all, and some other things peculiar, as this or that figure or magnitude, which distinguish them from one another; it considers apart, or singles out by itself, that which

† Introduction to the Principles of Human Knowledge.

(K) Principal Campbell, treating of the commonly received doctrine of abstraction, and having shown, that though Locke has in one passage of his immortal work expressed himself on the subject in terms unintelligible, his sentiments on the whole differed little from those of Berkeley and Hume, adds—"Some of the greatest admirers of that eminent philosopher seem to have overlooked entirely the preceding account of his sentiments on this subject; and, through I know not what passion for the paradoxical (I should rather say the impossible and unintelligible), have shewn an amazing zeal for defending the propriety of the hasty expressions which appear in the passages formerly referred to. Has not the mind of man (say they) an unlimited power in moulding and combining its ideas? The mind, it must be owned, hath an unlimited power in moulding and combining its ideas. It often produces wonderful forms of its own out of the materials originally supplied by sense; forms indeed of which there is no exemplar to be found in nature:—centaurs and griffins,

Gorgons and hydras, and chimeras dire.

But still it must not attempt absolute impossibilities, by giving to its creature contradictory qualities. It must not attempt to conceive the same thing to be black and white at the same time; to be no more than three inches long, and yet not less than three thousand; to conceive two or more lines to both equal and unequal; the same angle to be at once acute, obtuse, and right;" or, we may add, the two sides of a triangle to be not greater than the third. See *Philosophy of Rhetoric*, vol. ii. p. 108, &c.

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which is common, making thereof a most abstract idea of extension, which is neither line, surface, nor solid, nor has any figure or magnitude, but is an idea entirely prescinded from all these. So likewise the mind, by leaving out of the particular colours perceived by sense that which distinguishes them one from another, and retaining that only which is common to all, makes an idea of colour in abstract, which is neither red, nor blue, nor white, nor any other determinate colour. And as the mind frames to itself abstract ideas of qualities or modes, so does it by the same precision or mental separation attain abstract ideas of the more compounded beings, which include several coexistent qualities. For example: The mind having observed that *Peter*, *James*, and *John*, resemble each other in certain common agreements of shape and other qualities, leaves out of the complex or compounded idea it has of *Peter*, *James*, and any other particular man, that which is peculiar to each, retaining only what is common to all, and so makes an abstract idea wherein all the particulars equally partake, abstracting entirely from and cutting off all those circumstances and differences which might determine it to any particular existence. After this manner, it is said, we come by the abstract idea of *man*, or, if you please, humanity or human nature: in which, it is true, there is included colour, because there is no man but has some colour; but then it can be neither *black* nor *white*, nor any *particular* colour, because there is no one particular colour wherein all men partake. So likewise there is included stature; but then it is neithere tall stature, nor low stature, nor middle stature, but something abstrasted from all these; and so of the rest. Moreover, there being a great variety of other creatures that partake in some parts, but not all, of the complex idea *man*; the mind, leaving out those parts which are peculiar to man, and retaining those only which are common to all the living creatures, frameth the idea of *animal*; which abstracts not only from all particular men, but also from all birds, beasts, fishes, and insects. The constituent parts of the abstract idea of animal, are body, life, sense, and spontaneous motion. By *body*, is meant body without any particular shape or figure, there being no one shape or figure common to all animals, without covering either of hair or feathers or scales, &c. and yet not naked; hair, feathers, scales, and nakedness, being the distinguishing properties of particular animals, and for that reason left out of the *abstract idea*. Upon the same account, the spontaneous motion must be neither walking, nor flying, nor creeping: it is nevertheless motion; but what that motion is, it is not easy to conceive.

85 controverted; and

"Whether others have this wonderful faculty of *abstracting their ideas* (continues the Bishop), they best can tell; for myself, I find indeed that I have a faculty of imagining or representing to myself the ideas of those particular things which I have perceived, and of variously compounding and dividing them. I can imagine a man with two heads, or the upper parts of a man joined to the body of a horse. I can consider the hand, the eye, the nose, each by itself abstracted or separated from the rest of the body. But then, whatever hand or eye I imagine, it must have some particular shape, and some particular colour.—Likewise the idea of man that I frame to myself, must be either of a white, or a black, or a tawney, a straight or a crooked, a tall or a low, or a middle-sized man. I cannot by any effort of thought conceive the abstract idea above described. To be plain, I own myself able to abstract in one sense, as when I consider some particular parts or qualities separated from others with which, though they are united in some objects, yet it is possible they may really exist without them. But I deny that I can abstract one from another, or conceive separately those qualities which it is impossible should exist so separated; or that I can frame a general notion by abstracting from particulars in the manner aforesaid; and there are grounds to think most men will acknowledge themselves to be in my case."

86 shewn to be absurd.

To think this there are indeed such good grounds, that it is probable some of our readers, little conversant with the writings of modern metaphysicians, are by this time disposed to suspect, that the Bishop in his zeal may have misrepresented the doctrine of *abstraction*; as no man in his senses who is not perverted by some darling hypothesis, can suppose himself capable of tagging together such monstrous inconsistencies, as magnitude which is neither large nor small, and colour which is neither white, red, green, nor black, &c. But that the ingenious prelate, in his account of this process of *lopping* and *pruning*, as Mr Harris contemptuously, but most properly, terms it, has not exaggerated in the smallest degree, is apparent from the following account of *abstraction* given by Mr Locke. "*Abstract ideas* (says that writer) are not so obvious or easy to children, or the yet unexercised mind, as particular ones. If they seem so to grown men, it is only because by constant and familiar use they are made so: for when we nicely reflect upon them, we shall find that general ideas are fictions and contrivances of the mind that carry difficulty with them, and do not so easily offer themselves as we are apt to imagine. For example, Does it not require some pains and skill to form the general idea of a triangle (which is yet none of the most abstract comprehensive and difficult)? for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon, but *all and none of these at once*. In effect, it is some thing imperfect that cannot exist, an idea wherein some parts of several different and *inconsistent* ideas are put together." "Surely (to use the words of principal Campbell*) the bare *mention* of this hypothesis is equivalent to a confutation of it, since it really confutes itself." But if any man has the faculty of framing in his mind such an idea of a triangle as is here described, it would be vain in us to dispute with him; for we are possessed of no such faculty, and therefore would fight on unequal terms. All we have to desire is, that the reader would fully and certainly inform himself whether he has such an idea or not; and this can be no hard task to perform. What is more easy for any one than to look a little into his own thoughts, and there try whether he has, or can attain to have, an idea of *colour*, separated from all *extension*; of *extension*, which is neither *great* nor *small*; of *taste*, which is neither *sweet* nor *bitter*, nor *acid*,

* Philosophy of Rhetoric.

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acid, nor *agreeable*, nor *disagreeable*; or the general idea of a triangle, which is neither *oblique* nor *rectangle*, *equicural*, *equilateral*, nor *scalenon*, *but all and none of these at once* (L)?

87 Abstract conceptions the same with abstract ideas.

Dr Reid having denied that there are or can be in the mind any *ideas* of sensible objects, rejects of course the doctrine of *abstract general ideas*, whilst he maintains in fact the same thing, only substituting the word *conception* for the word *idea*. "What hinders me (says he) from attennidg to the whiteness of the paper before me, without applying that colour to any other object?" We know nothing indeed which can hinder any man from performing this operation, which is daily and hourly performed by infants; but will the Doctor say, that he can attend to colour, or conceive it, abstracted from the paper and every other surface? We are persuaded he will not, though he immediately adds, "the whiteness of this individual object is an *abstract conception*." Now we should rather have thought, that, consistent with his own notions of colour, he would have called the whiteness of the paper a *concrete quality*, and his own conception of it a *particular* and *concrete conception*. If he conceives the whiteness as separated from the paper, it is no longer the whiteness of that individual object: and he must either conceive it as abstracted from *all* objects, which is plainly impossible: or he must conceive it as inhering in some other object; and then neither the quality of whiteness, nor his conception of it, is abstract and general, but concrete and particular. He affirms, however, "that in abstraction, strictly so called, he can perceive nothing that is difficult either to be understood or practised." This is going much farther into the doctrine than Mr Locke went: for he owned that there was much difficulty in it. Let us see how it becomes so easy to Dr Reid. "What can be more easy (says he) than to distinguish the different attributes which we know to belong to a subject? In a man, for instance, to distinguish his size, his complexion, his age, his fortune, his birth, his profession, and twenty other things that belong to him." All this indeed, and much more, we can do with the utmost ease; but this is not abstraction, strictly so called, nor any thing like abstraction. We distinguish the size, the complexion, the age, &c. of the man, from *one another*: but still we conceive them all as *his* qualities; nor is it possible, at least for us, *to abstract them from him*, without conceiving them as the qualities of some *other* man; so that *our* conceptions are all concrete and particular. "It ought likewise to be observed (says the Professor), that attributes may with perfect ease be distinguished and *disjoined* in our conception, which cannot be *actually separated* in the subject." They may be so in his conception, but certainly not in ours; for *we* can conceive nothing which may not actually exist. "Thus (continues he) I can in a body distinguish its solidity from its extension, and its weight from both. In extension, I can distinguish, length, breadth, and thickness yet none of these can be separated from the body, or from one another. It is therefore *certain*, that attributes, which in their nature are absolutely inseparable from their subject and from one another, may be disjoined in our conception; one *cannot exist* without the other, but one *can be conceived* without the other." So far is this from being a matter of *certainty*, that in every possible sense in which we can understand the word *conception*, it appears to us as evidently *false*, as that *three* and *two* are equal to *nine*. It is indeed not difficult to distinguish *in* a body its solidity from its extension, and its weight from both: but can we distinguish them *out* of the body? or, to speak in plain language, can we conceive *solidity* as separated from *all extension* and *all weight?* Unless this can be done, and by *us* it cannot be done, there is no *abstraction strictly so called*. It is indeed easy to conceive *solidity* or *extension* abstracted from *any one* individual object: but how is it done? Why, by transferring your attention to some other *individual object*. Thus, we can easily conceive *solidity* or *extension* separated from a guinea, for instance; but it is only by transferring our thoughts to another body, *a piece of silver*, or a *ball of lead*, &c. and our conceptions in both cases are *particular* and *concrete*.

As we think the opinion of Dr Reid's respecting ABSTRACTION both ill-founded and of dangerous consequences, we have expressed our dissent from it in strong terms; and in doing so we have only followed the example set us by himself when dissenting from the theories of Hume and Berkely. But we are so thoroughly convinced that the Doctor's acuteness is superior to our own (L), that we are not without our fears that we may have mistaken his meaning. We are conscious that we have not wilfully misrepresented it; and to enable our readers to judge for themselves between him and us, we shall lay before them his definition of *general conceptions* in his own words.

88 Terms, how they are

That there are in every language *general terms*, is known to all mankind: for such are all substantives, proper names excepted; and all adjectives. But "it is impossible (says the Doctor*) that words can have a general signification, unless there be conceptions in the

* Essay on the Intellectual Powers of Man.

(L) "If such an extraordinary faculty (abstraction) were possible, I cannot for my part conceive what purpose it could serve. An idea hath been defined by some logicians, the form or resemblance of a thing in the mind; and the whole of its power and use in thinking is supposed to arise from an exact conformity to its archetype. What then is the use or power of that idea, to which there neither is nor can be any archetype in nature, which is merely a creature of the brain, a monster that bears not the likeness of any thing in the universe!"——*Philosophy of Rhetoric*, vol. ii. p. 110.

(L) Notwithstanding this declaration, which is made with the greatest sincerity, we do not apprehend that we are guilty of presumption when we examine the Doctor's opinions. Berkley and Hume were certainly as acute as any metaphysician who has succeeded them; yet their opinions have been canvassed without ceremony, and to much advantage. *Aliquando bonus dormitat Homerus.*

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the mind of the speaker and of the hearer, of things (M) that are *general*. It is to such that I give the name of *general conceptions*: and it ought to be observed, that they take this denomination, not from the act of the mind in conceiving, which is an individual act; but from the object or thing conceived, which is general." Now, whatever is conceived, must be either *external* to the mind, or *present* with it. But the Doctor himself acknowledges, "That all the objects we perceive are individuals. Every object of sense, of memory, or of *consciousness*, is an individual object. All the good things we enjoy or desire, and all the evils we feel or fear, must come from individuals; and I think we may venture to say, that every creature which God has made in the heavens above, or in the earth beneath, or in the waters under the earth, is an individual." If this be so, and no man can call it in question, it is obvious that we can have no *general* conception of any thing *external*. The *act* of conceiving is *an individual act*; and therefore the only thing which can be *general*, must be something present with the mind, and different from the *mere act of conceiving*: But what can this be, if not what Berkeley and others call an *idea*? and how can we have an *idea* of which we are not *conscious*? yet every thing of which we are conscious Dr Reid himself acknowledges to be an *individual*.

89 of general signification.

But if the Doctrine generally received respecting abstract ideas be so very absurd as it has appeared in our representation, how comes it to be so prevalent among the acutest philosophers? To this we answer, that those philosophers have certainly in this instance been imposed upon by the structure of language. Every adjective and every substantive, proper names excepted, are words of general signification; and all science is conversant about general truth: but as words are said to be significant, not of things, but of ideas; and as truth results from the agreement or coincidence of ideas; it has been hastily supposed, that without general ideas there could have been neither general terms nor general truth. This is plausible, but it is not solid. Every object which affects our senses is an individual object; but we perceive that two or more objects which affect some of our senses very differently, affect others of them in precisely the same way. Thus, the paper upon which one writes, the snow which he perceives from his window, and the milk which he may use at breakfast, affect his senses of touch and taste very differently, but they present the same appearance to his eye. This diversity in the one case he believes to proceed from different powers or qualities in the several objects; and the sameness of appearance in the other, from similar qualities in these objects. To the similar qualities, though he can frame no idea of them abstracted from every individual object, he gives one common name; and calls every object which presents the same appearance to his eye that snow does, a *white* object; where the word *white* does not stand for an abstract idea, but for a quality inherent in one or more objects. Hence the origin of adjectives in language, which denote more than can be expressed by any class of substantives; for every adjective, besides the power of a name, includes in itself the force of a conjunction. See GRAMMAR.

The other class of general terms comprehends substantives: of which the origin is as follows. The objects about which we have occasion to speak or write are so numerous and so fluctuating, that if every individual had a proper name, a complete language could never be formed. But as there are not perhaps in nature two objects that appear to us similar in all respects, so are there not in nature two objects which affect *all* our senses differently. The mind, therefore, either actually perceiving two or more objects at once, or contemplating the *ideas* left by two or more objects in the memory, perceives, by its intellective power, in what respects they agree and in what they disagree. If the agreement be striking, and in more qualities than one, it combines the several individuals into one class or species, giving to the whole a common name, which equally denotes the species and every individual belonging to it. Thus, observing that Peter, James, and John, agree in having the same erect form, in walking on two legs, in having hands, &c. and in being endowed with reason, we combine these three, and all other individuals which we perceive to agree in the same striking and important qualities, into one species, to which we give the name of *man*—a word which equally denotes the whole species and every individual of it. Again, contemplating several figures, which all agree in the circumstance of being bounded by three straight lines meeting one another so as to form three angles, we call the whole class of figures and each individual by the name of *triangle*—though it may be impossible to contemplate any number of triangles without perceiving that all the angles of one are acute; that one angle of another is a right angle; and that in the third there is one angle obtuse: but the word *triangle*, unless it is limited in its signification by the addition of an adjective, is equally expressive of an acute-angled triangle, a right-angled triangle, and an obtuse-angled triangle. By thus arranging individuals according to their most conspicuous qualities, we may combine all the objects existing into so many classes or species, which shall be afterwards known by as many names; but of each species we neither have, nor can have, any other idea than that of a multitude of similar individuals.

As our acquaintance with nature enlarges, we discover resemblances striking and important between one species and another, which naturally begets the notion of a higher class called a *genus*. From comparing man with beasts, birds, fishes, and reptiles, we perceive that they are all alike possessed of life, or a principle of sensation and action, and of an organised body: hence we rank them all under a higher class or genus, to which we give the name of *animal*; which equally denotes the whole *genus*, each *species* comprehended under the *genus*, and every *individual* of every *species*. Thus, *animal* is a *genus*; *man*, *beast*, *bird*, are so many *species* comprehended under that *genus*; and *Peter*, *James*, and *John*, are *individuals* of the species *man*. *Peter*, *James*, and *John*, are proper names, denoting each an *individual*;

(M) He tells us soon afterwards, that there are *no things general*. How is the one passage to be reconciled with the other?

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dual; man, beast, bird, are *specific* terms, denoting each a *whole species* comprising many *individuals;* and *animal* is a *general term,* because it denotes a *whole genus,* comprehending under it *several species,* of which each consists of *many individuals;* and the general term denotes either the whole *genus,* all the *species,* or any *individual* of all the species. This is the whole mystery of *abstraction:* they are merely *terms,* that in strictness of speech are *general* and *abstract;* and even these are general only as *signs,* of which the full signification cannot always be represented by any conceivable *idea.*

90 Names and ideas often used as mere signs.

"It is a received opinion (says Bishop Berkeley), that language has no other end but the communicating of our ideas, and that every significant name stands for an idea. This being so; and it being withal certain, that names, which yet are not thought altogether insignificant, do not always mark out particular conceivable ideas; it is straight way concluded that they stand for abstract notions. That there are many names in use amongst speculative men, which do not always suggest to others determinate particular ideas, is what nobody will deny: and a little attention will discover, that it is not necessary, even in the strictest reasonings, that significant names, which stand for ideas, should every time they are used excite in the understanding the ideas they are made to stand for. In reading and discoursing, names are for the most part used as letters in algebra; in which, though a particular quantity be marked by each letter, yet to proceed right, it is not requisite that in every step each letter suggest to our thoughts that particular quantity it was appointed to stand for. The same thing is true of ideas, which as well as names are often used merely as signs representing a whole class; and on that account they may be called *general,* though every idea is in itself strictly particular. Thus, "An idea, which considered in itself is particular, becomes general by being made to represent or stand for all other particular ideas of the same sort. To make this plain by an example, suppose a geometrician is demonstrating the method of cutting a line in two equal parts: He draws, for instance, a black line of an inch in length: this, which in itself is a particular line, is nevertheless with regard to its signification, general; since, as it is there used, it represents all particular lines whatsoever: so that what is demonstrated of it is demonstrated of all lines, or, in other words, of a line in general. And as that particular line becomes general by being made a sign; so the *name* line, and the *idea* of a line in the imagination, either of which taken absolutely is particular, by being signs are made general likewise. And as the former owes its generality, not to its being the sign of an abstract or general line, but of all particular right lines that may possibly exist; so the latter, the name and the idea, must be thought to derive their generality from the same cause, namely, the various particular lines which each of them indifferently denotes." Again, when one demonstrates any proposition concerning triangles, it is to be supposed that he has in view to demonstrate an universal truth; yet the particular triangle which he considers must be either equilateral, isosceles, or scalenon; for a plain triangle, which is none of these, can neither exist nor be conceived. But whether it be of this or that sort is of no importance, as any of them may equally stand for and represent all rectilineal triangles, and on that account be denominated *universal.*

This doctrine respecting names and ideas being used merely as *signs,* has been adopted by almost every subsequent philosopher; and by Principal Campbell it has been illustrated with perspicuity and acuteness every way worthy of the author of the Dissertation on Miracles. "In confirmation of this doctrine (says he *), it may be observed, that we really think by *signs,* as well as speak by them. All the truths which constitute science, which give exercise to reason, and are discovered by philosophy are general; all our ideas, in the strictest sense of the word, are particular. All the particular truths about which we are conversant are properly historical, and compose the furniture of memory. Nor do I include under the term *historical* the truths which belong to natural history; for even these too are general. Now, beyond particular truth or historical facts, first perceived and then remembered, we should never be able to proceed one single step in thinking any more than in conversing without the use of signs.

* Philosophy of Rhetoric.

"When it is affirmed that *the whole is equal to all its parts,* there cannot be an affirmation which is more perfectly intelligible, or which commands a fuller assent. If, in order to comprehend this, I recur to ideas, all that I can do is to form a notion of some individual whole, divided into a certain number of parts of which it is constituted; suppose of the year, divided into the four seasons. Now all that I can be said to discern here is the relation of equality between this particular whole and its component parts. If I recur to another example, I only perceive another particular truth. The same holds of a third and of a fourth. But so far am I, after the perception of ten thousand particular similar instances, from the discovery of the universal truth, that if the mind had not the power of considering things as signs, or particular ideas as representing an infinity of others, resembling in one circumstance though totally dissimilar in every other. I could not so much as conceive the meaning of an universal truth. Hence it is that *some ideas,* to adopt the expression of Berkeley, *are particular in their nature, but general in their representation.*"

91 Which, though particular in themselves, serve to demonstrate general truths; because

But if in universal propositions, ideas particular in themselves be used only as the signs of others, it may be demanded, how we can know any proposition to be true of all the ideas which are represented by the sign? For example, having demonstrated that the three angles of an isosceles rectangular triangle are equal to two right ones, how can we conclude that this affection therefore agrees to all other triangles which have neither a right angle nor two equal sides? To this question Bishop Berkeley and Principal Campbell give the following answer: Though the idea we have in view whilst we make the demonstration be that of an isosceles rectangular triangle, whose sides are of a determinate length, we may yet be certain that the demonstration extends to all other rectilineal triangles of what sort or bigness soever; for this plain reason, that neither the equality nor determinate length of the sides, nor the right angle, are at all concerned in the demonstration. It is true, the idea or diagram we have in view includes all these particulars; but then there is not the least mention made of them in the

proof

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proof of the proposition. It is not said the three angles are equal to two right angles, *because* one of them is a *right angle*, or because the sides comprehending it are of equal length; which sufficiently shows that the right angle might have been oblique and the sides unequal; and for all that the demonstration have held good. In every one of Euclid's theorems, a particular triangle, and a particular parallelogram and a particular circle, are employed as signs to denote all triangles, all parallelograms, and all circles. When a geometrician makes a diagram with chalk upon a board, and from it demonstrates the property of a straight-lined figure, no spectator ever imagines that he is demonstrating a property of nothing else but that individual white figure, five inches long, which is before him.—Every one is satisfied that he is demonstrating a property of all of that order, whether more or less extensive, of which it is both an example and a sign; all the order being understood to agree with it in certain characters, however different in other respects. Nay, what is more, the mind, with the utmost facility extends or contracts the representative power of the sign as the particular occasion requires. Thus the same equilateral triangle will with equal propriety serve for the demonstration, not only of a property of all equilateral triangles, but of a property of all isosceles triangles, or even of a property of all triangles whatever. Nay, so perfectly is this matter understood, that if the demonstrator in any part should recur to some property belonging to the particular figure he hath constructed, but not essential to the kind mentioned in the proposition, and which the particular figure is solely intended to represent, every intelligent observer would instantly detect the fallacy: So entirely for all the purposes of science doth a particular serve for a whole species or genus. Now, why one *visible* individual should in our reasonings serve without the smallest inconvenience as a sign for an infinite number, and yet one *conceivable* individual, or a particular idea of imagination, should not be adapted to answer the same end, it will, we imagine, be utterly impossible to say (N).

It must, however, be confessed, that there is a considerable difference in kind, between *ideas* used as signs and the *general* terms of any language. Amongst all the individuals of a species, or even of the highest genus, there is still a natural connection, as they agree in the specific or generic character; and when the mind makes use of any positive idea as the sign of the species or genus, that idea appears in the imagination as an exact resemblance of some one individual. But the connection which subsists between words and things, or even between words and ideas, is in its origin arbitrary; and yet its effect upon the mind is much the same with that of the natural connection between ideas and things. For having often had occasion to observe particular words used as signs of particular things, and specific terms used as signs of a whole species, we contract a habit of associating the sign with the thing signified, insomuch that either being presented to the mind necessarily introduces or occasions the apprehension of the other. Custom in this instance operates precisely in the same manner as natural resemblance in the other; so that certain sounds, and the ideas of things to which they are not naturally related, come to be as thoroughly linked in our conceptions as the ideas of things and the things themselves. Nay, so completely are they linked together, that we often use, through long chains of reasoning, certain sounds or words, without attending at all to the ideas or notions of which they are signs. "I believe (says the author of *A Treatise on Human Nature*), that every one who examines the situation of his mind in reasoning will agree with me, that we do not annex distinct and complete ideas to every term we make use of; and that in talking of *government*, *church*, *negotiation*, *conquest*, we seldom spread out in our minds all the simple ideas of which the compound notions signified by these terms are composed. It is, however, observable, that notwithstanding this imperfection, we may avoid talking nonsense on these subjects, and may perceive any repugnance among the ideas, as well as if we had a full comprehension of them." This remark generally holds true; but then it is to be observed, that all the words used as signs, and which yet do not denote any one conceivable determinate *idea*, must be capable of definition. Thus, in matters that are perfectly familiar, in simple narration, or in moral observations on the occurrences of life, a man of common understanding may be deceived by specious falsehood, but is hardly to be gulled by downright nonsense or a repugnance of ideas. Almost all the possible applications of the terms (in other words, all the acquired relations of the signs) have become customary to him. The consequence is, that an unusual application of any of them is instantly detected; this detection breeds doubt, and this doubt occasions an immediate recourse to *definition*; which, proceeding through species and genera, resolves complex terms into others less complex, till it ends at last in simple ideas and relations, which can neither be defined nor misunderstood (O). See LOGIC.

Thus

(N) Were it possible to frame an *abstract general idea* of a triangle, which is neither equilateral, isosceles, nor scalenon, even *that idea* must be used merely as a sign as much as any particular triangle whatever: and the question might still be asked, How we can know any proposition to be true of all the triangles represented by the sign? For example: having demonstrated that the three angles of an ideal triangle, which is neither equilateral, isosceles, nor scalenon, are equal to two right angles, how can we conclude that this affection agrees to triangles which are equilateral, &c.? To this question it is not easy to conceive what answer could be given other than that of Berkeley and Campbell, in the case of using particular and conceivable triangles as signs.

(O) Since this article was written, some excellent observations on the common doctrine concerning abstraction have been given to the public by professor Dugald Stewart of Edinburgh. See *Elements of the Philosophy of the Human Mind.*

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92 it is not the matter but the power of the sign that is regarded by the mind.

Thus then we see, that though there are no ideas, properly speaking, general and abstract, a man may by *terms* and *particular* ideas, used as *signs*, arrive at the knowledge of general truth. In neither case is it the *matter*, if we may be allowed the expression, but the *power* of the sign, that is regarded by the mind. We find, that even in demonstrative reasonings, signs the most arbitrary, or mere symbols, may be used with as little danger of error as ideas or natural signs. The operations both of the algebraist and arithmetician are strictly of the nature of demonstration. The one employs as *signs* the letters of the alphabet, the other certain numerical characters. In neither of these arts is it necessary to form ideas of the quantities and sums signified; in some instances it is even impossible without resolving the quantity or sum into parts, in a manner analogous to definition; and then the mind comprehends not the whole quantity or number at once, but the several parts of which it is composed, which it connects (P) by the relation of junction or addition. Yet without this resolution, the equations and calculations carried on by means of the letters and figures significant of the whole quantity or the whole sum, are not the less accurate or convincing. And so much for *abstraction*, *generalization*, and the power of *signs*, whether *natural* or artificial.

Chap. V. *Of the* Association *of* Ideas.

93 A continued train of thought in the mind,

Every man whilst awake is conscious of a continued train of thought spontaneously arising in his mind and passing through it; nor could a single now or instant be pitched upon in which some idea is not present in his memory or imagination. No one idea, however, unless detained by a voluntary exertion of the mind, or unless productive of intense pleasure or pain, remains long in the imagination; but each hastens off the stage to make way for another, which takes its turn and is succeeded by a third, &c. We are not to imagine that this train of thought is altogether fortuitous and incoherent. "It is evident (says Mr Hume *), that there is a principle of connection between different thoughts or ideas of the mind; and that, in their appearance to the memory or imagination, they introduce each other with a certain degree of method and regularity. In our more serious thinking or discourse this is so observable, that any particular thought which breaks in upon the regular tract or chain of ideas, is immediately remarked and rejected. Even in our wildest and most wandering reveries, nay, in our very dreams, we shall find, if we reflect, that the imagination ran not altogether at adventures, but that there was still a connection upheld among the different ideas which succeeded each other. Were the loosest and freest conversation to be transcribed, there would immediately be observed something which connected it in all its transitions: Or, where this is wanting, the person who broke the thread of discourse might still inform you, that there had secretly revolved in his mind a succession of thoughts, which had gradually led him from the subject of conversation. Among different languages, even where we cannot suspect the least connection or communication, it is found, that words expressive of ideas the most compounded, do yet nearly correspond to each other; a certain proof that the simple ideas comprehended in the compound ones, were bound together by some universal principle, which had an equal influence on all mankind."

* Essays,

Association of Ideas.

94 Principles of association.

That these observations are well founded, every man may be satisfied by looking attentively into his own thoughts; but when the author reduces the principles of this association of ideas to *three*, viz. *resemblance*, *contiguity* in time and place, and *cause* or *effect*, he certainly contracts them within too narrow a compass. That these principles often serve to connect ideas, will not indeed be denied. A picture leads our thoughts to the original: the mention of one apartment in a building introduces an inquiry or discourse concerning the others: and if we think of a wound, we can hardly forbear reflecting on the pain which follows it. But surely ideas sometimes succeed each other without *resemblance*, without *contiguity* in time or in place, and without being connected by the relation of a *cause* to its *effect*. Besides all this, there are other associations than of *ideas*. Ideas are associated with passions and emotions, and passions and emotions are associated together. A particular idea is associated with a proper name, and often with the general name of the species. General conceptions, such as those which Mr Locke calls mixed modes (see Mode), are associated with signs both audible and visible, and signs are associated with each other. Surely virtue, as it consists in action and intention, does not resemble the *sound* virtue, is not *contiguous* to it in time or in place, and is neither its *cause* nor its *effect*; nor is it conceivable, that the arbitrary signs of different things should have any natural relation to one another.

But were the enumeration complete, the bare mention of these principles does not account for the phenomena: For, granting the fact, it may still be asked, Why does a picture lead our thoughts to the original; or the mention of one apartment in a building introduce an inquiry concerning the others? To these questions our author has given no answer; nor are we acquainted with any writer who can be said to have attempted it, except Dr Hartley and his ingenious editor. There may be some of our readers whom the names of these men will prejudice against their theory; but, doubtless, the greater part are willing to adopt truth, or to examine an ingenious speculation, from whatever quarter it comes. To such as feel themselves otherwise disposed, we beg leave to say, that if they allow the name of *Priestley* to disgust them at what follows, they will furnish him with a new proof of the truth of the doctrine which they reject.

That

(P) No man, we think, will pretend that he can perceive at one view a million of individual men, or that he can imagine or conceive at once a million of ideal men: yet he may divide the million into parts, which in the one case may be easily viewed, and in the other may be easily conceived, in succession. Thus, 100+100+100, &c.

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95 How they operate.

That *ideas* ſhould be aſſociated together, ſeems to be inevitable from the manner in which the mind acquires them. All our ideas, properly ſpeaking, are of ſenſible objects, and by far the greater part of them of *viſible* objects. But every ſenſible object conveys at once various ſenſations and perceptions to the mind, which appear not only united in fact, but inſeparable in imagination. Thus, when a man looks at any particular object, a tree for inſtance, he perceives the *trunk*, *branches*, *leaves*, *ſize*, *ſhape*, and *colour*, &c. of the whole at *once*: he does not firſt perceive the *figure* of the trunk, then its *ſize*, then its *colour*, then the *branches*, &c. all in ſucceſſion; but a perception of the *whole* is conveyed to the mind by one ſimultaneous impreſſion (Q.) We have already ſeen, that the ſenſes, in fact, convey nothing to the mind but their reſpective ſenſations; and that the perception of the external object inſtantly follows the ſenſation. We have likewiſe ſeen, that ſenſation is occaſioned by ſome impreſſion, concuſſion, or vibration, given to the nerves and brain, and by them communicated to the mind or percipient being. We have likewiſe ſeen, that memory depends as much upon the brain as original ſenſation, and is always attended or occaſioned by ſimilar concuſſions or vibrations, &c. Theſe are facts proved by univerſal experience, and which, we believe, no thinking man has ever called in queſtion. It follows, therefore, that every actual ſenſation muſt leave ſome effect in the brain, either an actual print, which ſeems to be impoſſible, or a tendency to vibrate or be agitated in the ſame way as when the original impreſſion was made. This being the caſe, it is natural to conclude, that when any part of the original perception is revived in the memory, the whole perception ſhould be revived at once, ſo as that we cannot have an idea of the trunk of a tree without perceiving the ideas of the branches aſſociated with it. This is indeed not merely natural, but the contrary ſeems to be impoſſible; for as the original agitation or vibration was occaſioned by the whole tree, it is evident, that whatever effect or tendency that agitation or vibration left behind it, muſt be left by the whole vibration, and therefore be equally related to the whole tree.

But no object ſtands ſingle in nature. When we view a tree, or any thing elſe, we always notice, however tranſiently, the field where it grows and the objects around it. Theſe too leave effects in the brain at the ſame time that the tree does ſo; and therefore make their appearance with it in the memory or imagination: but if the tree was the object to which we principally attended during the actual ſenſation, the idea of it will be much more vivid than the idea of its adjuncts, and remain much longer in the imagination or memory; becauſe the original ſenſation by which it was perceived, was ſtruck much deeper than the ſenſations by which its adjuncts were perceived. All this muſt be intelligible to every one who attends to what we have already ſaid of ſenſation, perception, and memory.

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Thus we ſee why a picture leads our thoughts to the original, and why the mention of one apartment in a building introduces an inquiry concerning the others. It is not merely becauſe the picture *reſembles* the original, and becauſe the apartments of a building are *contiguous*. Between a plain ſurface, variouſly coloured and ſhaded, and the contour of the human face, there is certainly very little real reſemblance, as any man may be convinced who places his eye within ſix inches of a good picture. But the painter, having by his ſkill in perſpective, contrived to lay his colours on the plain canvas in ſuch a manner as that they reflect the ſame rays of light with the original, provided the ſpectator ſtand at the proper diſtance; theſe rays proceeding from the picture fall upon the eye in the ſame direction, and therefore give to the nerves and brain the very ſame impulſe which was given by the original. When one apartment of a building is mentioned, we inquire concerning the others from the very ſame cauſe that, when we think of the trunk of a tree which we have ſeen, we cannot avoid thinking likewiſe of its branches.

96 Association gives meaning to the words of language

But the principle of aſſociation takes place among things not naturally connected, as the apartments of a building and a ſubſtance and its attributes and adjuncts. It is aſſociation which is the original ſource of all the general or complex conceptions which we have, and which even gives meaning to the words of every language. Between ſounds conſidered in themſelves, and things, or the ideas of things, every one knows that there is no natural connection; yet the idea of every known object is in the mind of every man ſo ſtrictly aſſociated with the name that it bears in his native tongue, that the preſence of the one always ſuggeſts the other. It cannot indeed be otherwiſe, if we attend to the manner in which a child learns to affix a meaning to the words which he hears. —A child knows his mother and nurſe, and indeed almoſt every viſible object in the family, long before he acquires the power of articulation. The impreſſions made

(Q.) This is certainly the caſe with adults, but it may be doubted whether it be ſo with very young children. It has been ſhown already, that the ſenſation communicated by the eye from any viſible object, has not the leaſt reſemblance to that object; and that in looking at a tree or any thing elſe, a full grown man pays not the leaſt attention to the appearance which the tree really makes to his eye; nay, that he is not even conſcious of that appearance, farther than as it conſiſts in colour. It is by the ſenſe of touch only that we acquire ideas of figure, even of plain figure; and we imagine that we perceive them by the eye only, becauſe different figures, as diſtinguiſhable by touch, are ſo cloſely aſſociated with their correſponding viſible ſenſations, that long before we are capable of inquiry, theſe two things are inſeparable in the imagination. It is otherwiſe with children, who, when they firſt begin to diſtinguiſh objects by the ſenſe of ſight, appear to do it with great deliberation, as if they firſt felt the proper ſenſation of light and colours ſo or ſo modified, and afterwards acquired, by ſomething like a mental inference, a notion of the figure at which they are looking.

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made by these objects, and repeated daily and hourly on his brain, every one of which excites a sensation, must soon become so deep as not to be easily effaced. Numbers of them too are associated together, so that the presence of one introduces the other. It has been already observed, that ideas of sight are the most vivid and the most lasting; but the child having the same sound often repeated, even that sound comes in time to leave in his memory a permanent idea. He then hears the sound *nurse*, for instance, uttered at the time when he is looking earnestly at the person of the nurse, with whom he is well acquainted, and to whom he is strongly attached; and having the two ideas repeatedly excited together, they soon become so associated, that the one necessarily excites the other: the *word nurse* calls into view the *idea* of the *woman* treasured up in his imagination.

But we need not have recourse to children for the proof of our assertion. It is obvious that the name of every simple and uncompounded idea can be significant only by association. Of a complex conception the name may be made intelligible by a definition; but simple ideas cannot be defined, and between ideas and sounds there is no natural connection, so as that the one previous to association should suggest the other. Even of complex conceptions and mixed modes, the meaning of the names is generally acquired by association; for though it is certainly true, that all such names are capable of definition, they are yet used with sufficient propriety by thousands who know not what a definition is. Were a plain unlettered man asked to define virtue, it is not probable that he could do it so as to make himself understood; yet having ideas of the *practice of justice*, *charity*, *fortitude*, &c. strictly associated in his mind with the *word virtue*, he may know the general meaning of that word as well as the most acute grammarian or the most profound philosopher.

An *alms* is a donation to a poor man; but a child who never heard of this definition knows perfectly what an *alms* is, from having often seen his parents give money to a beggar, and call what they were doing by the name *alms*. The sound of the word, after having seen the first alms given, will excite in his mind an idea of the *individual* object who received it, and of the *action* of him by whom it was given; but after having seen several poor men relieved, he comes to associate with the word *alms* any thing given to any person who needs it or appears to be in want.

So completely does this association take place between ideas or clusters of ideas, and the words by which they are expressed, that even men of letters hear and understand perfectly many words without reviewing in their minds all the ideas and relations of which they are the signs. It has been already observed, that in talking of *government*, *church*, *negotiation*, *conquest*, we seldom spread out in our minds all the simple ideas of which the compound notions signified by these terms are composed; and we now add, that the terms may be used with sufficient propriety, and be perfectly understood by those who never attempted to analyse the notions of which they are significant into their primary and constituent parts. Every man has read numberless details of the transactions of one court with another; he has heard such transactions universally called by the term *negotiation*. The term and the transactions signified by it are so closely associated in his mind, that they are in a manner inseparable; and by this association he knows the meaning of the term better than he could have done by the most complete definition; which, perhaps he would find it difficult to give, or even to comprehend.

97 and is the source of our first notions of virtue.

We have said that the *meaning* of the word *virtue* is acquired by association, by having often heard that sound applied to certain *actions*; but it is extremely probable, that the very *notion* of virtue, simple and uncompounded as it appears to be, is acquired in the very same manner. The *first* rudiments of the notions of *right* and *wrong* and *obligation* seem to be acquired by a child when he finds himself checked and controled by superior power. At first he feels nothing but mere *force*, and consequently has no notion of any kind of restraint but that of necessity. He finds he cannot have his will, and therefore he submits. Afterwards he attends to many circumstances which distinguish the commands of a *father*, or of a *master*, from those of any other person. Notions of *reverence*, *love*, *esteem*, and *dependence*, are connected with the idea of him who gives those commands; and by degrees the child experiences the peculiar *advantages* of filial subjection. He sees also that all his companions, who are noticed and admired by others, obey their parents; and that those who are of a refractory disposition are universally disliked. These and other circumstances now begin to alter and modify the notion of mere necessity, till by degrees he considers the commands of a parent as something that *must not* be resisted or disputed, even though he has a power of doing it; and all these ideas coalescing, form the notions of *moral right* and *moral obligation*, which are easily transferred from the commands of a parent to those of a magistrate, of God, and of conscience. This opinion of the gradual formation of the ideas of moral right and wrong, from a great variety of elements associated together, perfectly accounts for that prodigious diversity in the sentiments of mankind respecting the objects of moral obligation; nor do we see that any other hypothesis can account for the facts. If the notion of moral obligation were a simple uncompounded idea, arising from the view of certain actions or sentiments; or were it acquired, as it certainly might be, by a chain of reasoning from the nature of God and the nature of man; why should it not in the one case be as invariable as the perception of colours or sounds, and in the other as our judgements of mathematical or physical truths? But though the shape and colour of a flower appear the same to every human eye; though every man of common understanding knows, that if a billiard ball be struck by another, it will move from its place with a velocity proportioned to the force of the impulse; and though all mankind who have but dipt into mathematics, perceive that any two sides of a triangle must be greater than the third side; yet one man practises as a moral duty what another looks upon with abhorrence, and reflects on with remorse. Now a thing that varies with education and instruction, as moral sentiments are known to do, certainly has the appearance of being generated by a series of different impressions and associations in some such manner as we have endeavoured to describe. Let not any man imagine that this account of the origin of moral sentiments endangers the cause of virtue; for whether those

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those sentiments be instinctive or acquired, their operation is the very same, and in either case their rectitude must often be tried by the test of reason, so that the interests of virtue are equally safe on this as on any other scheme. See *Moral Philosophy*.

98 It ought, therefore, to be attended to in the education of youth.

This principle of association has so great an influence over all our actions, passions, reasonings, and judgments, that there is not perhaps any one thing which deserves more to be looked after in the education of youth. Some of our ideas—such as those of a substance and its attributes, a genus and the species contained under it, a species and its several individuals, have a real connection with each other in nature. These it is the office of our reason to trace out and to hold together in that union and order in which nature presents them to the view of the mind; for such associations constitute perhaps the greatest part of necessary and of useful truths. But there are others formed by custom and caprice, which are too often the sources of error, superstition, vice, and misery—of errors the more dangerous, and of vice the more deplorable; that if the associations have been long formed without an attempt to dissolve them, they generally become at last too strong to be broken by the most vigorous effort of the best disposed mind. Thus, let a foolish maid * amuse or rather frighten children with stories of ghosts appearing in the dark, let her repeat these fictions till they have made a deep impression on the young minds, and the notion of ghosts will in time become so closely associated with the idea of darkness, that the one shall always introduce the other; and it may not be in the power of the children, after they have become men, and are convinced in their judgments of the falsehood and absurdity of the tales which originally frightened them, to separate entirely the notion of ghosts from the idea of darkness, or with perfect ease to remain alone in a dark room. Again, let the idea of *infallibility* be annexed to any person or society, and let these two inseparably united constantly possess the mind; and then one body in ten thousand places at once shall, unexamined, be swallowed for an incontrovertible fact, whenever that infallible person or society dictates or demands assent without enquiry.

* Locke's Essay, and his Conduct of the Understanding.

Some such wrong and unnatural combinations of ideas will be found to establish the irreconcileable opposition that we find between different sects in philosophy and religion; for we cannot imagine every individual of any sect to impose wilfully on himself, and knowingly to reject truth offered by plain reason. That which leads men of sincerity and good sense blindfold, will be found, when inquired into, to be some early and wrong association. Ideas independent and of no alliance to one another, are by education, custom, and the constant din of their party, so linked together in their minds, that they can no more be separated from each other than if they were but one idea; and they operate upon the judgment as if they really were but one. This gives sense to jargon, the force of demonstration to absurdities, and consistency to nonsense: it is the foundation of the greatest and most dangerous errors in the world; for as far as it obtains, it hinders men from seeing and examining.

Before we dismiss the subject of association, it may be proper to enquire, how far it is agreeable to the account which we have given of the manner in which external objects are perceived by means of the senses, and the ideas of such objects retained in the memory. —It has been proved, we think, by arguments unanswerable, that by the organs of sense nothing is conveyed immediately to the mind but sensations which can have no resemblance to external objects, and that the perception of an object may be resolved into a process of reasoning from effects to causes.—But children it will be said, do not reason from effects to causes, and yet they soon acquire the faculty of perceiving and distinguishing the objects with which they are surrounded. This is an undoubted truth, and it can be accounted for only by the principle of association. A child has as much the use of his senses as a full grown man. By his eye he has the sensation of colour; by his nose, that of smell; by his ear he has the sensation of sound; and by his hand he feels heat and cold, resistance and bounded resistance. Every object which is presented to him, impresses his mind with various sensations: and these sensations combined together are probably all that he perceives for some years; for there is no reason to imagine that a boy of one or two years old has the slightest notion of what we mean by solidity, hardness, softness, or indeed of that which is termed *substance*. Yet when two or more objects are present, he may easily distinguish the one from the other, because the sensations excited by the one must differ from those excited by the other, as much as the real qualities of the one are different from the real qualities of the other; and by distinguishing between his own sensations, he in effect distinguishes between the objects which produce these sensations. His sensations too being frequently excited, leave behind them ideas in his memory or imagination; and those ideas, from having been imprinted together and never separated, become in time so closely associated, that whenever one of them is called into view, the others necessarily make their appearance with it. Thus a child has a set of combined sensations excited in his mind by the presence of his nurse; he has a different cluster excited, suppose, by the presence of his mother. These are often repeated, and leave deep traces behind them; so that when the mother or the nurse makes her appearance, she is immediately recognised as a known object; or, to speak more correctly, the child feels the very same sensations which he has felt before, from which he has experienced pleasure, and of which he has the ideas treasured up in his memory or imagination. A stranger, on the other hand, must affect him with a set of new sensations, and of course will be distinguished from a known object as accurately as if the child were possessed of the notions of solidity, substance, qualities, and distance. A man born blind, who knew not that such things as fire and snow had ever existed, would yet distinguish the one from the other the moment that he should be brought within their influence. He could not indeed apply their names properly, nor say which is the fire and which the snow, nor would he at first have any notion of either of them as a real, external, and distant object; but he would certainly distinguish his own sensations, the sensation of heat from that of cold. It is just so with a child: At first he perceives nothing but different sensations. These he

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99 The principle of association operates in our perception of external objects;

can

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can distinguish; and as they are caused by different objects, in distinguishing between the sensations he will appear to distinguish between the objects themselves. In a short time, however, he acquires, by the following process, some inaccurate notions of distance. He looks, for instance, earnestly in his nurse's face, and at the same time touches her cheek perhaps by accident. He repeats this operation frequently, till the sensation communicated by his eye comes to be associated with that of his touch, and with the extending of his arm; and being all treasured up as associated ideas in the memory, the sight of his nurse makes him ever afterwards stretch out his hands with a desire to touch her. All this while there is not the slightest probability that the child has any notion of *substance* or *qualities*, or of any thing beyond his own *sensations*, and the means by which he has experienced, that sensations which are pleasant may be obtained, and that such as are painful may be avoided. The precise time at which a child begins to think of external things we cannot pretend to ascertain; but we are persuaded that it is later than many persons imagine, and certainly not till he has made considerable progress in the exercise of reason. Prior to that period the things which men know to be bodies, are known to children only as sensations and ideas strongly bound together by the tie of association.

100 and seems to distinguish memory from imagination;

But if association be of such importance in the act of sensation, it is of still greater in that of retention; for it seems to constitute the whole difference that there is between imagination and memory. By many of the ancients, as well as by some modern philosophers, these two faculties seem to have been confounded with each other; but between them there is certainly a great difference, though they likewise resemble each other in some respects. An idea of memory, considered by itself, makes the very same appearance to the intellect as an idea of imagination. We contemplate both as if they were actual, though faint and distant perceptions: but the one is attended with the conviction, that it is the idea of an object which has really been perceived at some period of past time; whilst the other is attended with no conviction, except that the idea itself is actually present to the mind. Mr Hume has said, that ideas of memory differ from those of imagination only in being more vivid and distinct; but certainly this is not always the case. An idea of imagination has sometimes been taken for a real perception, which an idea of memory can never be. The difference between those two kinds of ideas, we are persuaded, arises chiefly, if not wholly, from association. Every idea of memory is associated with many others, and those again with others down to the very moment of the energy of remembrance; whereas ideas of imagination are either the voluntary creatures of the fancy at the moment of their appearance, in which case we should call them conceptions; or they are ideas which we have actually received from sensation, but which, on account of some link being broken in the vast chain of association, we cannot refer to any real objects. What gives probability to this conjecture is, that ideas often appear in the mind which we know not whether to refer to the memory or imagination, nothing being more common than to hear a person say, I have in my head the idea of such or such an object; but whether I remember or only imagine the object, I am very uncertain. Afterwards, however, by turning the idea over and over in the mind, he finds other ideas make their appearance, till at last clusters of them come into view, and associate so closely with the principal idea, which was the object of doubt, as to convince the judgment that it is an idea of memory.

101 and to be the ground of our belief of what we remember.

It has been asked, Why we believe what we distinctly remember? and to that question it has been supposed that no answer can be given. But it appears to us, that association is the ground of belief in this as it will be found to be in other instances; and that a man believes he washed his hands and face in the morning, because the idea of that operation is so strongly linked in his mind to the whole train of ideas which have arisen, in it through the day, that he cannot separate the first from the last, that which was a sensation in the morning from the sensations which are present at the instant of remembrance. As those ideas are associated by nature, each must pass in review in its proper order; so that in so short a space of time there is no danger, and hardly a possibility, of taking the first for the last, or the last for the first. Nay more, we will venture to hazard an opinion, that every past event of a man's life, which he distinctly remembers, is tied by the chain of association to his present perceptions. That this is possible is certain, since it is not difficult to conceive how it may be done. The principal events of a single day may surely be so linked together as to be all distinctly reviewed in a cluster of ideas on the morrow. Of these events some one or other must be the most important, which will therefore make its appearance as an idea more frequently than the rest, and be more closely associated with the events of next day. Some event of that day will, for the same reason, be more closely associated with it than the others; and these two, dropping perhaps all the rest of their original companions, will pass on together to the third day, and so on through weeks and months and years In the compass of a year, several things must occur to make deep impressions on the mind. These will at first be associated together by events of little importance, like the occurrences of a single day. Whilst these feeble chains, however, continue unbroken, they will be sufficient to link the one important event to the other, and to bring them both into view at the same time, till at last these two, from appearing so often together, will in time unite of themselves, and the intermediate ideas be completely effaced. Thus may two or three important events of one year be associated with such a number of similar events of another year, so that the ideas of the one shall always introduce to the mind the ideas of the other; and this chain of association may pass from the earliest event which we distinctly remember through all the intermediate years of our lives down to the instant when memory is exerted.

To this account of memory it may perhaps be objected, that it gives us no distinct notion of time. Every thing that is remembered is necessarily believed to have been present in some portion of past time; but association brings into view nothing but a series of events. This objection will be seen to have no weight when we have inquired into the nature of time, and ascertained what kind of a thing it is. It will then

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then perhaps appear, that duration itself, as apprehended by us, is not distinguishable from a series of events; and that if there were no train of thought passing through our minds, nor any motion among the objects around us, time could have no existence. Meanwhile, whatever become of this opinion, we beg leave to observe, that our theory of remembrance is perfectly consistent with the commonly received notions respecting time; and indeed, that it is the only theory which can account for numberless phenomena respecting past duration. It is universally allowed, that if motion or a succession of events do not constitute time, it is the only thing by which time can be measured. Now it is a fact which no man will deny, that the distance of time from the present *now* or instant to the earliest period which he distinctly remembers, appears to his view extremely short, much shorter than it is said to be in reality; and that one year, when he looks forward, appears longer than two, perhaps longer than ten, when he looks backward. Upon our principles this fact is easily accounted for. We remember nothing which is not linked by a chain of associations with the perceptions of the present moment; and as none but a few of the most important events of our lives can be linked together in this manner, it hence follows, that events which, in the order of succession, were far *distant* from each other, must thus be brought *together* in the memory, and the whole chain be contracted within very short limits. But when we figure to ourselves a series of future events, we employ the active power of fancy instead of the passive capacity of retention; and can therefore bring within the compass of one periodical revolution of the sun a longer series of imaginary events succeeding each other, than is preserved of real events in our memory from the earliest period of our existence. So perfectly does our theory accord with this well-known fact. On the other hand, if memory be an original faculty of the mind totally independent of association, and of which no other account is to be given than that it necessarily commands our belief, why is it a faculty which, with regard to duration, thus uniformly deceives us? and how comes it to pass, that to a man whose memory is tenacious, who has read much, seen many countries, and been engaged in various occurrences, any determinate portion of past time always appears longer than to another man whose memory is feeble, and whose life has been wasted in ease and idleness? To these questions we know not what answer can be given upon any other principle than that which makes the evidence of memory depend upon association. But if we remember nothing but what is linked to the perception or idea which is present with us at the time of remembrance, and if duration be measured by the succession of events, it is obvious that any portion of past time must necessarily appear longer to him who has many ideas associated in his mind than to him who has but few.

102 The importance of association in the philosophy of the human mind.

There is not perhaps a single fact of greater importance in the philosophy of the human mind than the *association of ideas*; which, when thoroughly understood, accounts for many of those phenomena which some late writers of name have, with injury to science and with danger to morality, attributed to a number of distinct and independent instincts. It is for this reason that we have considered it so minutely, and dwelt upon it so long; and in addition to what we have said on the subject, we beg leave to recommend to our more philosophical readers the diligent study of Hartley's Observations on Man (R). In that work we think several things are taken for granted which require proof; and some which, we are persuaded, have no foundation in nature: but, with all its defects, it has more merit than any other treatise on the sensitive part of human nature with which we are acquainted.

Chap. VI. *Of* Consciousness *and* Reflection.

103 Consciousness, what it is, and what are its objects.

Sensation, remembrance, simple apprehension, and conception, with every other actual energy or passion of the mind, is accompanied with an inward feeling or perception of that energy or passion; and that feeling or perception is termed *consciousness*. *Consciousness* is the perception of what passes in a man's own mind at the *instant* of its passing there; nor can we *see*, *hear*, *taste*, *smell*, *remember*, *apprehend*, *conceive*, employ our faculties in any manner, enjoy any pleasure, or suffer any pain, without being *conscious* of what we are doing, enjoying, or suffering. *Consciousness* is only of things *present* *; and to apply it to things *past*, is to confound *consciousness* with memory or *reflection*. One cannot say that he is conscious of what he has seen or heard and now remembers: he is only conscious of the act of remembrance; which, though it respects a past event, is itself a present energy. It is likewise to be observed that consciousness is only of things in the mind or conscious being, and not of things external. It is improper in any person to say that he is *conscious* of the table before him: he perceives it, he *sees* it; and he may with great propriety say that he is *conscious* he perceives or sees it; but he cannot say that he is conscious of the table itself, for it is only his immediate energy of perception that can be the object of consciousness. All the operations of our minds are attended with consciousness; which is the only evidence that we have or can have of their existence. Should a man take it into his head to think or to say that his consciousness may deceive him, and to require a proof that it cannot, we know of no proof that can be given him; he must be left to himself as a man that denies first principles, without which there can be no reasoning. Every attempt to prove this point, or to set it in a clearer light, would only serve to render it more dark and unintelligible. I *think*, I *feel*, I *exist*, are first truths, and the bases of all human knowledge.

* Reid's Essays on the Intellectual Powers of Man.

104 Des Cartes's argument from consciousness for his own existence.

This has given rise to the question, whether Des Cartes did not fall into an absurdity when, inferring his own existence from his actual thought, he said, *Cogito, ergo sum?* This argument has been called a pitiful sophism, and a *petitio principii*; because, before a man

(R) Since this was written Mr Stewart's *Elements of the Philosophy of the Human Mind* have been published; in which the reader will find many excellent remarks on the nature and influence of the associating principle.

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man take it for granted that he thinks, he must also, it is said, take it for granted that he exists, since there cannot be thought where there is no existence. Now it must be confessed, that if Des Cartes pretended by this argument to give us a fresh conviction of our own existence, his endeavours were useless and puerile; because a man capable of being convinced by the arguments of another, must have a previous conviction of his own existence: but the argument itself is certainly neither a sophism nor a *petitio principii*. Those* who defend Des Cartes assert, that there is no reason to doubt the truth of their assertion, that his only view in urging such an argument was not to prove the truth of our existence, but to exhibit the order of that process by which we arrive at the knowledge of the fact; and this he has very clearly done by analysing the truth into its first principles. A stone exists as well as the human mind; but has the stone any knowledge of its own existence? No man will say that it has; neither should we have any knowledge of ours, did we think as little as the stone. We certainly *might* exist without thinking, as it is probable we do in very sound sleep; and in that state our existence might be known to other beings, but it could not possibly be known to ourselves: for the only things of which the mind is conscious, or has immediate knowledge, are its own operations. I *exist* is therefore a legitimate inference from the proposition I *think*; and the observation that it is so may be useful to show us the procedure of the mind in the acquisiton of knowledge; but it has little merit as an argument, and still less as a discovery, though, being strictly true and just, it should never have been exposed to ridicule.

* See Buffier's First Truth.

105 Reflection, what it is, and how different from consciousness.

It is to be observed, that we are conscious of many things to which we give very little attention. We can hardly attend to several things at the same time; and our attention is commonly employed about that which is the *object* of our thought, and rarely about the thought itself. It is in our power, however, when we come to the years of understanding, to give attention to our own thoughts and passions, and the various operations of our minds. And when we make these the objects of our attention, either while they are present, or when they are recent and fresh in our memory, we perform an act of the mind which is properly called *reflection*. This *reflection* ought to be distinguished from *consciousness**, with which it is confounded sometimes by Locke, and often by the learned author of Ancient Metaphysics. All men are *conscious* of the operations of their own minds at all times while they are awake, nor does it appear that brutes can be wholly destitute of consciousness; but there are few men who *reflect* upon the operations of their minds, or make them the objects of thought; and it is not probable that any species of brutes do so.

* Reid's Essays on the Intellectual Powers of Man.

From infancy, till we come to the years of understanding, we are employed solely about sensible objects. And although the mind is conscious of its operations, it does not attend to them; its attention is turned solely to the objects about which these operations are employed. Thus, when a man is angry, he is *conscious* of his passion; but his *attention* is turned to the *person* who offended him and the *circumstances* of the *offence*, while the *passion of anger* is not in the least the object of his attention. The difference between *consciousness* and *reflection*, is like the difference between a superficial view of an object which presents itself to the eye while we are engaged about something else, and that attentive examination which we give to an object when we are wholly employed in surveying it. It is by consciousness that we immediately acquire all the knowledge which we have of mental operations; but attentive reflection is necessary to make that knowledge accurate and distinct. *Attention* is a voluntary act; it requires some exertion to begin and continue it; and by great exertion it may be continued for a considerable time; but *consciousness* is involuntary, and of no continuance, changing with every thought. The power of reflection upon the operations of their own minds does not at all appear in children. Men must have come to some ripeness of understanding before they are capable of it. Of all the powers of the human mind it seems to be the last that unfolds itself. Most men seem incapable of acquiring it in any considerable degree; and many circumstances conspire to make it to all men an exercise of difficulty. The difficulty, however, must be conquered or no progress can be made in the science of our own or of other minds.

106 All our notions of mental energies got by reflection.

All the notions which we have of mind and of its operations are got by reflection; and these notions are by Mr Locke called *ideas of reflection*. This term we think extremely ill chosen; and we believe it has been the source of much error and confusion among Locke's followers. A man, by attending to the operations of his own mind, may have as distinct *notions* of remembrance, of judgment, of will, of desire, as of any object whatever: but if the secondary perception of a sensible object, that appearance which it has to the mind when viewed in the memory or imagination, be properly called an *idea*, it is certain that of the operations of the mind itself there can be no ideas; for these operations, when reflected on, make no appearance without their objects either in the memory or in the imagination. Nothing is more evident, in fact, than that we have no *ideas*, in the original and proper meaning of the word, but of sensible objects, upon which the mind exerts its first operations. Of these operations we have indeed a consciousness; but abstracted from their objects we cannot frame of them any idea of resemblance. We are *conscious* to ourselves of *thinking*, *willing*, *remembering*, *discerning*, *reasoning*, *judging*, &c. but let any one look into himself, and try whether he can there find any *idea* of *thinking* or *willing*, &c. entirely separate and abstracted from the *object* of thought or will. Every man who has seen a tree or a house, will find in his mind ideas of these objects, which he can contemplate by themselves, independent of every thing else; but no man can contemplate the *idea* of thinking or desiring without taking into view the thing thought on or desired. It is plain, therefore, that the energies of *thinking*, *willing*, and *desiring*, with all their various modifications, are not themselves *ideas*, or capable of *communicating* ideas to be apprehended, as the ideas of bodies are apprehended by the pure intellect. They are the *actions* and *workings* of the *intellect itself* upon ideas which we receive from the objects of sense, and which are treasured up in the memory or imagination for the very purpose of furnishing the intellect with materials to work.

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work upon. Between *ideas* and the *energies of thinking* there is as great and obvious a difference as there is between a *stone* and the *energies* of him by whom it is cast. Ideas are the passive subjects; the energies of thinking are the operations of the agents. Ideas are relicts of sensation, and have a necessary relation to things external; the energies of thinking are relicts of nothing, and they are wholly and originally internal.

107 Our knowledge of the operations of intellect immediate and not by the intervention of ideas.

That we can in no sense of the word be said to have *ideas* of the operations of the intellect, will be still more evident if we consider by what means we acquire the knowledge which we have of those operations. It has been already observed, that when our thoughts are employed upon any subject, though we are conscious of thinking, yet our *attention* is commonly employed upon the *object* of our thought, and not upon the *thought* itself: and that if we would give attention to our thoughts and passions, we must do it by a reflex act of the mind, whilst the act of thinking is still recent and fresh in our memory. Thus, if a man wishes to know what perception is, it is not the time to make the inquiry while he is looking at some rare or beautiful object; for though he is *conscious* of the energy of perceiving, the *object* of perception employs all his *attention*. But the time to make this enquiry is either when the object has become familiar to him, or presently after it is removed from his sight. In the former case, he can look upon it without emotion, pay attention to every step in the process of perception, and be immediately conscious what perception is. In the latter case, by turning his attention inwards, and reflecting on what he did or felt when the object was before him, he will find clear and vivid ideas of every thing which he perceived by his sense of sight; but he will find no *idea* of the act of *seeing* or *perceiving*. On the contrary, if he be capable of sufficient attention, he will observe that his intellect is employed in the very same manner upon the *ideas* that it was upon the original *sensations*; and of that employment, and the manner of it, he will be equally conscious as he was of the original energy exerted in sensation. There is indeed this difference between the two, without which reflection could make no discoveries, that the most vivid ideas being still faint when compared with actual sensations, the intellect is not so wholly engrossed by them as it was by the original objects, nor is it so rapidly carried from idea to idea as it was from sensation to sensation. It is thus at leisure to attend to its own operations, and to know what they are; though to form *ideas* of them as separate from their objects, is absolutely impossible. Every man capable of paying attention to what passes within himself when he sees, hears, and feels, &c. may have very accurate *notions* of *seeing*, *hearing*, and *feeling*, &c. but he cannot have *ideas* of them as he has of the *objects* of *sight*, *hearing*, and *touch*.

The same is the case with respect to the exertion of our reasoning faculties. A man must have distinct and clear *ideas* to reason upon, but he can have no *idea* of reasoning itself, though he must be conscious of it, and by attention may know what it is. When a man sits down to study for the *first time* a proposition in the Elements of Euclid, he certainly employs his reasoning faculty, and is conscious that he is doing so; but his attention is wholly turned to the diagram before him, and to the several ideas which the diagram suggests. Afterwards when he has mastered the proposition, he may go over it again, with a view to discover what reasoning is; but he will not find he has any *idea* of reasoning as he has of the diagram. He will only exert that faculty a second time, and perceive one truth linked to and depending upon another in such a manner that the whole taken together forms a complete demonstration. In a word, the operations of our own minds, when attention is paid to them are, known immediately by consciousness; and it is as impossible that we should have ideas of them, as that a living man should be a picture upon canvas. He who attends to what passes in his own mind when he perceives, remembers, reasons, or wills, must know by consciousness what these operations are, and be capable of forming very accurate notions of them, as connected with their objects; and he who does not attend to what passes in his own mind will never acquire any notions of them, though he were to read all that has been written on the subject from the days of Pythagoras to those of Dr Reid.

108 There are things which we know partly by sensation and partly by reflection, &c.

As we acquire ideas of external objects by means of our senses; and notions of perceiving, remembering, reasoning, and willing, &c. by reflecting on the operations of our own minds; so are there other things of which we acquire notions, partly by sensation, partly by reflection, and partly by means of that faculty of which it is the more peculiar office to compare ideas and to perceive truth. Such are *substance*, *body*, *mind*, with their several qualities, adjuncts, and relations; the knowledge of which, as has been already observed, constitutes what in strictness of speech is termed the science of *metaphysics*. These shall be considered in order, after we have investigated the nature of truth, and inquired into the several sources of evidence; but there is one notion, about the origin and reality of which there have been so many disputes, which in itself is of so great importance, and which will be so intimately connected with all our subsequent inquiries, that it may not be improper to consider it here.—The notion to which we allude is of POWER.

109 Our notion of power how acquired.

Among the objects around us we perceive frequent changes, and one event regularly succeeding another. Gold thrown into the fire is changed from a fixed to a fluid body. Water exposed to a certain degree of cold is changed from a fluid to a fixed body. Night succeeds to day, and summer succeeds to winter. We are conscious of new sensations in ourselves every hour. We are likewise conscious of reasoning, willing, and desiring; and we know that by an exertion of will we can rise or sit, stand still or walk, call one idea into view, and dismiss others from our contemplation. Experience teaches us, that it is not occasionally, but always, that gold is changed into a fluid by being thrown into the fire, and water into a fixed body by being exposed to a certain degree of cold; that night succeeds to day, and summer to winter. These changes have regularly taken place since the creation of the world; and it has never once been observed that water was fixed by fire, or gold rendered liquid by cold. Were we not assured by experience that our own voluntary motions are produced by exertions of our minds, of which we are conscious, and that without such

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such exertions those motions would never have taken place, we should probably have considered the liquifaction of gold as an event equally independent of fire, though uniformly conjoined with it, as night is independent of day and day of night. But having experienced that we can move and not move our bodies as we please; that when it is our will to sit, we never get up to walk; and that when we wish to walk, we always do it except prevented by external violence; having likewise experienced, that by a thought, by some internal and inexplicable, exertion of our minds, we can call up in our memory or imagination one idea and dismiss others from our mental view; we are led to believe with the fullest conviction, that all those motions of our bodies which in common language are termed *voluntary* and that succession of ideas which follows a conscious exertion of the mind, depend upon ourselves. In other words, we are necessitated to believe that we have a *power* to move or not move our bodies in many cases, and a *power* to turn our attention to one idea in preference to others.

It is thus that we acquire the notion of *power* in ourselves, which we easily transfer to other objects. Knowing that the various motions of our bodies thus effected proceed from power, we are naturally led to inquire whether the changes which we perceive in other bodies may not proceed from *power* likewise *i. e.* from something analogous to that power, of the exertions of which we are conscious in ourselves. Now uniform experience teaching us that gold is liquified by being thrown into the fire, and that water is fixed by being exposed to cold; we infer with the utmost certainty that there are *powers* in fire and cold to produce these changes, and that without the exertion of such *powers* these changes, would not be produced. We cannot indeed say of external powers, as we can of our own, in what substance they inhere. We know with the utmost certainty that the voluntary motions of our hands, &c. are produced by a power not inherent in the hands but in the mind, for of the exertion of that power we are conscious; but we do not know whether the power which liquifies gold be inherent in that sensible object which we call *fire*, or in something else to which fire is only an instrument. We learn by observation, that the minute particles of fire or heat insinuate themselves between the particles of gold, and if we may use the expression, tear them asunder; but whether they do this in consequence of a *power* inherent in themselves, or only as instruments impelled by another *power*, is a question which *observation* cannot enable us to answer.

Were we not conscious of the exertion of our own powers, it seems not conceivable that we could ever have acquired any notion of power at all; for power is not an object of sense, nor, independent of its operations, is it indeed an object of consciousness. In external operations, all that we perceive is *one thing*, in which we suppose the *power* to reside, followed by another, which is either the *change* or that on which the change is *produced;* but the exertion of the power itself we do not perceive. Thus we perceive gold, after it has been some time in the fire, converted from a fixed to a fluid body; but we perceive not by our senses either the power or the energy of the power which operates to this conversion. In the exercise of our own powers, the case is otherwise. When a man puts his hand to his head, and afterwards thrusts it into his bosom, he not only perceives by his senses the change of position, but is also conscious of the energy or exertion by which the change was produced.

"Suppose (says Mr Hume †) a person, though endowed with the strongest faculties of reason and reflection, to be brought on a sudden into this world; he would indeed immediately observe a continual succession of objects, and one event following another, but he would not be able to discover any thing farther. He would not at first by any reasoning be able to reach the idea of cause and effect; since the particular powers by which all natural operations are performed never appear to the senses. The impulse of one billiard ball is attended with motion in the second. This is the whole that appears to the *outward* senses. The mind feels no sentiment or *inward* impression from this succession of objects; consequently there is not, in any single particular instance of cause and effect, any thing which can suggest the idea of power or necessary connection. From the first appearance of an object, we never can conjecture what effect will result from it: but, were the power or energy of any cause discoverable by the mind, we could foresee the effect even without experience; and might at first pronounce with certainty concerning it by the mere dint of thought and reasoning. It is impossible, therefore, that the idea of power can be derived from the contemplation of bodies in single instances of their operations; because no bodies ever discover any power which can be the original of this idea."

† Essays.

There is a sense in which this reasoning is unquestionably just. A man who had never been conscious of exerting power in himself, would certainly not acquire the notion of power from observing a continual succession of external objects. The impulse of one billiard ball being followed by the motion of another, would no more lead him to the notion of power in the former, than the succession of night to day would lead him to the notion of a power in light to produce darkness. When Mr Hume says, "that from the *first* appearnce of an object *we* can never conjecture what effect will result from it." he uses language that is ambiguous, and utters an assertion which is either true or false according to the sense in which it is understood. If it be meant, that after having reflected on the operations of our own minds, and learned by experience that motion is communicated by impulse from one ball of ivory to another, we could not conjecture whether a similar effect would be produced by the impulse of balls made of other hard bodies which we had never before seen, the assertion is manifestly false. A man who had but once seen motion communicated in this manner from one *ivory* ball to another, would certainly conjecture that it might be communicated from one *wooden* ball to another; and if he had seen it repeatedly communicated from one ball to another of different substances, he would infer, with the utmost confidence, that it might be communicated from ball to ball of whatever substance composed, provided that substance be hard, or of a similar texture with the balls to the impulse of which he had formerly paid attention.

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attention. If by this ambiguous phrase the author only means, as is probably the case, that from the first appearance of an object to which we had never before observed any thing in any respect similar, we could not conjecture what effect would result from it; or if his meaning be, that a man suddenly brought into the world, who had never acquired such a notion of power as may be had from attention to the energies and operations of our own minds, would not, by observing an effect to result from one body, conjecture from the first appearance of another similar body what effect would result from it; in either of these cases his assertion is certainly true, and tends to prove, that without the consciousness of the operations of our own minds we could never acquire a notion of power from the changes perceived by our senses in external objects.

110 Mr Hume attempts to prove that we can have no notion whatever of power.

But Mr Hume, not contented with denying, which he might justly do, that we could ever have derived the idea of power merely from observing the continual succession of external objects, labours hard to prove that we have no notion of power at all, and that when we use the word *power*, we do nothing more than utter an insignificant sound. To pave the way for the arguments by which so extravagant a paradox is to be supported, he lays it down as a "proposition which will not admit of much dispute, that all our ideas are nothing but copies of our impressions; or, in other words, that it is impossible for us to *think* of any thing that we have not antecedently *felt* either by our external or internal senses." As this proposition, however, will admit, it seems of *some* dispute, he takes care, before he applies it to the purpose of demolishing all power, to support it by two arguments. "First (says he), when we analyse our thoughts or ideas, however compounded or sublime, we always find that they resolve themselves into such simple ideas as were copied from a precedent feeling or sentiment. Those who would assert, that this position is not universally true nor without exception, have only one, and that an easy, method of refuting it; by producing that idea, which, in their opinion, is not derived from this source. Secondly, If it happen, from a defect of the organ, that a man is not susceptible of any species of sensation, we always find that he is as little susceptible of the correspondent ideas. A blind man can form no notion of colours, a deaf man of sounds. And tho' there are few or no instances of a like deficiency in the mind, where a person has never felt, or is wholly incapable of a sentiment or passion that belongs to his species; yet we find the same observation to take place in a less degree. A man of mild manners can form no idea of inveterate revenge or cruelty; nor can a selfish heart easily conceive the heights of friendship and generosity."

111 His reasoning sophistical.

As these propositions are the engines by which all power is banished from the world, it may not be improper, before we proceed to inquire by what means they perform so arduous a task, to consider their own inherent strength; for if they be weak in themselves, their work, however dexterously they may be employed, can have no stability. We have already noticed the perverseness of this writer's language, when it confounds *sensations* with *impressions*; but here it is still more perverse, for passions, sentiments, and even *consciousness*, are styled *impressions*. When sensations are confounded with impressions, the effect is only mistaken for the cause, it being universally known that sensations proceed from impressions made upon the organs of sense. When consciousness is confounded with an impression, one thing is mistaken for another, to which it is universally known to have neither resemblance nor relation. But, not to waste time upon these fallacies, which, though dangerous if admitted, are yet too palpable to impose upon a reader capable of the slightest attention, let us examine the propositions themselves. The most important, and that for the sake of which alone the others are brought forward, is, that it is impossible for us to *think* of any thing that we have not immediately *felt*, either by our external or internal senses." Did Mr Hume then never *think* of a mathematical *point*, or a mathematical *line*? Neither of these things is capable of being *felt* either by making an impression upon the organs of sense or as an object of consciousness; and therefore it is impossible that he should ever have had ideas of them such as he doubtless had of sensible objects; yet in the most proper sense of the word *think* (s), he certainly thought of both points and lines; for he appears to have made considerable progress in the science of geometry, in which he could not have proceeded a single step without a perfect knowledge of these things, on which the whole science is built. It is not therefore true, that our thoughts or ideas, when analysed, always resolve themselves into such simple ideas as were copied from a precedent feeling or sentiment; for every mathematical figure of which we can think resolves itself into a point and motion; and a point having no parts and no magnitude, cannot possibly be the object of feeling to any of our senses. If, therefore, ideas alone be the objects of thought, we have refuted Mr Hume's position by the very method which he himself lays down; for we have produced an idea which is not derived either from a precedent feeling or a precedent sentiment. By sentiment, we suppose to be here meant that which by other philosophers is denominated consciousness; and of consciousness it is undeniable that nothing is the object but the actual energies of our own minds.

112 Things of which we can have no ideas may themselves be the objects of thought.

But ideas are not the only objects of thought. We have already given our reasons for restricting the word *idea* to that appearance which an object of sense, when reflected on, makes either in the memory or imagination. Such was undoubtedly its original signification; and had it never been used to denote other and very different objects, much error and perplexity would have been avoided, which now disgrace the science of metaphysics. Things may *themselves* be the objects of thought; and

(s) *Thinking*, in the propriety of the English tongue, signifies that sort of operation of the mind about its ideas wherein the mind is active; where it, with some degree of voluntary attention, considers any thing. *Locke*.

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and when that is the case, to think of their *ideas*, were it possible to do so, would be worse than useless; for we may certainly know a man better by looking at himself than by looking at his picture. Of things which are *themselves* the objects of thought, we have either a *direct* or a *relative* knowledge. We know directly the actual operations of our own minds by the most complete of all evidence, that of consciousness; and we have a *relative* notion of mathematical points and lines: but neither of mental energies nor of these external things (T) can we possibly have any *idea*.

113 We have only relative notions of some things, † Essays on the Active Powers of Man.

It is well observed by Dr Reid †, that our notions both of body and mind are nothing more than relative. "What is body? It is, say philosophers, that which is extended, solid, and divisible. Says the querist, I do not ask what the properties of body are, but what is the thing itself? let me first know directly what body is, and then consider its properties. To this demand I am afraid the querist will meet with no satisfactory answer; because our notion of body is not direct, but relative to its qualities. We know that it is something extended, solid, and divisible, and we know no more. Again, if it should be asked, what is mind? It is that which thinks. I ask not what it does, or what its properties are but what it is? To this I can find no answer; our notion of mind being not direct, but relative to its operations, as our notion of body is relative to its qualities (U)."

114 About which, however, we can reason with the utmost precision:

Our notion of a mathematical point is of the very same kind. What is a point? It is, says Euclid, that which hath no parts and no magnitude. Replies the querist, I ask not either what it has or what it has not let me first know what it is? To this second question, it might perhaps be answered, that a mathematical point is that which by motion generates a line. But, rejoins the querist, I am not inquiring what it generates; give me a direct idea of the point itself? or, if that cannot be done, as surely it cannot, tell me what its offspring a line is? A line, says Euclid, is length without breadth. I have no idea, replies the querist, of length without breadth. I never felt an *impression* from a sensible object which did not suggest length breadth, and thickness, as inseparably united; and I can have no idea which is not the *copy* of a *former impression*. To assist the querist's conception, it may be said that lines are the boundaries of a superficies, and that superficies are the boundaries of a solid body; but of a solid body every man has a clear and direct idea, in the most proper sense of the word. Here then are several things, viz. points, lines, and superficies, of not one of which is it possible to form a direct notion; and yet we know them so thoroughly, from the relation which they bear to other objects, that we can reason about them with a precision and certainty which only the mathematical sciences admit.

115 And such is power.

The great advantage of these sciences above the moral, Mr Hume himself expressly admits: but he attributes it to a wrong cause, when he says it consists in this, that the "ideas of the former being *sensible* are always clear and determinate;" for we see that the notion of a point or of a line is merely relative, and cannot possibly be the copy of a sensation, or, in his language, of a sensible impression. If then we have clear and determinate notions of points and lines, and may reason about them without ambiguity, as he acknowledges we may, what is there to hinder us from having an equally clear and determinate notion of power, or from reasoning about it with as little ambiguity (V)? Why, says he, we are not conscious of power. And to prove this position, which needs no proof, he makes

(T) By calling mathematical points and lines external things, we do not mean to attribute to them any corporeal existence. We know well that they are merely creatures of the mind, and that if there were no mind, they could have no existence. But twenty men may at the same instant have a notion of the same lines and the same points; and therefore these lines and points have an existence independent of, and external to, any *one* mind, at least to any one *human* mind. The objects, however, of which a man is conscious, are in no sense whatever external, for they are present to no human mind but his own.

(U) The opinions of philosophers concerning corporeal and spiritual substances shall be considered more fully hereafter. In quoting from Dr Reid on another subject, we have been obliged to anticipate his opinion, which will be found to be not more modest than just.

(V) "There are some things of which we can have both a direct and relative conception. I can directly conceive ten thousand men, or ten thousand pounds, because both are objects of sense, and may be seen. But whether I see such an object, or directly conceive it, my notion of it is indistinct; it is only that of a great multitude of men, or of a great heap of money; and a small addition or diminution makes no perceptible change in the notion I form in this way. But I can form a relative notion of the same number of men or of pounds by attending to the relations which this number has to other numbers greater or less. Then I perceive that the relative notion is distinct and scientific; for the addition of a single man, or a single pound, or even of a penny, is easily perceived. In like manner, I can form a direct notion of a polygon of a thousand equal sides and equal angles. This direct notion cannot be more distinct when conceived in the mind, than that which I get by sight when the object is before me; and I find it so indistinct that it has the same appearance to my eye, or to my *direct* conception, as a polygon of a thousand and one, or of nine hundred and ninety-nine sides. But when I form a *relative* conception of it, by attending to the relation it bears to polygons of a greater, or less number of sides, my notion of it becomes distinct and scientific, and I can demonstrate the properties by which it is distinguished from all other polygons. From these instances it appears, that our relative conceptions of things are not always less distinct, nor less fit materials for accurate reasoning, than those that are direct; and that the contrary may happen in a remarkable degree."

Reid's Essays on the Active Powers of Man.

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makes many observations that, however just, might certainly have been spared. Of these one is, that "a man suddenly struck with a palsy in the leg or arm, or who had now lost these members, frequently endeavours at first to move them, and employ them in their usual offices. Here he is as much conscious of power to command such limbs, as a man in perfect health is conscious of power to actuate any member which remains in its natural state and condition. But consciousness never deceives. Consequently, neither in the one case nor in the other are we ever conscious of any power." This is true; we never are conscious of any power; but we are frequently conscious of actual energies: and the man who, after being suddenly struck with a palsy, endeavours in vain to move his leg or arm, is as conscious of energy as he who in health makes the attempt with success. Nor let it be imagined that his consciousness deceives him; for, as Mr Hume justly observes, consciousness never deceives. He is certain of the *energy*, but finds by experience that the *instrument* of this energy has suddenly become disordered and unfit for its usual office. In this and this alone consists the difference between the paralytic and the man whose limbs are sound. The one may be as conscious of energy as the other, and his consciousness may be equally infallible. What then is this energy? Mr Hume will not say that it is an *idea*, for it is not the copy of any antecedent impression; besides, he has somewhere allowed that ideas are never active. Is it then a substance? Impossible! for it is not permanent: and we believe no man will venture to affirm, or even to suppose, that the same substance can be repeatedly annihilated, and as often created. Is it then the occasional exertion of some substance? This must be the truth; for no other supposition remains to be made. If so, that substance must be possessed of *power;* for a capacity of exerting actual energy is all that is meant by the word *power*. —"Wherever there is a *capability* of energy or exertion, there must be *power;* for though there can be no exertion without power, there may be power that is not exerted *. Thus a man may have *power* to speak when he is silent; he may have power to rise and walk when he sits still. But though it be one thing to *speak* and another to have the *power* of speaking, we always conceive of the power as something which has a certain relation to the effect; and of every power we form our notion by the effect which it is able to produce. Nor is it only in speaking and moving his limbs that a man is conscious of energy. There is as much energy, though of a different kind, in *thinking* as in *acting*. Hence the powers of the human mind have been divided into active and speculative. By the former we move the body; and by the latter we see, hear, remember, distinguish, judge, reason, and perform upon our notions and ideas every other operation which is comprehended under the general word *to think*."

* Reid's Essays on the Active Powers of Man.

116 Locke's passive power an improper expression.

Mr Locke † has introduced into his theory of power another distinction than that which we have made between active and speculative powers. Observing by our senses, under which on this occasion memory is certainly included, various changes in objects, we collect, says he, a possibility in one object to be changed, and in another a possibility of making that change, and so come by that idea which we call power. Thus we say that fire has a power to melt gold, and that gold has a power to be melted. The first he calls *active*, the second *passive*, power. But to say that the *possibility* of being changed is *power* seems to be a very improper mode of speaking, and such as may lead to consequences which the excellent author certainly held in abhorrence. It tends to make unwary readers imagine that the passive subject is as necessary to the existence of power, as the active being of which power is an attribute; but if the universe had a beginning, and if its Creator be immutable, two propositions which Mr Locke firmly believed, there certainly was power when there was no change, nor any thing existing which was capable of change. He owns, indeed, that active power is more properly called power than the other; but we see no propriety at all in passive power. "It is (in the language of Dr Reid) a powerless power, and a contradiction in terms."

† Essay, book ii. chap. 21.

117 Just observations of the same author respecting power as belonging to body or mind.

But though Locke here uses improper terms, he has other observations with which we have the honour fully to agree, and which lead to consequences the reverse of that impiety which seems to follow from the notion of *passive* power. He observes, that "we have from body no idea at all of thinking, nor any idea of the beginning of motion. A body at rest affords us no idea of any active power to move; and when it is set in motion itself, that motion is rather a passion than an action in it. For when the ball obeys the stroke of a billiard stick, it is not any action of the ball, but a passion; also, when by impulse it sets another ball in motion that lay in its way, it only communicates the motion it had received from another, and loses in itself so much as the other received; which gives us but a very obscure idea of an active power of moving in body, whilst we observe it only to transfer, but not to produce any motion. So that it seems to me, we have from the observation of the operation of bodies by our senses but a very imperfect obscure idea of active power, since they afford us not any idea in themselves of the power to begin any action either of motion or thought." He thinks it evident, however, "that we find in ourselves a power to begin or forbear, continue or end, several actions of our minds and motions of our bodies, barely by a thought or preference of the mind ordering, or, as it were, commanding, the doing or not doing such or such a particular action. This power which the mind has thus to order the consideration of any idea, or the forbearing to consider it, or to prefer the motion of any part of the body to its rest, and *vice versa* in any particular instance, is that which we call *will*. The actual exercise of that power, by directing any particular action, or its forbearance, is that which we call *volition* or *willing*.

118 Whence it follows, that only such beings as have will and understanding can possess real power.

According to Mr Locke, therefore, the only clear notion or idea we have of power is taken from the power which we find in ourselves to give certain motions to our bodies, or certain directions to our thoughts; and this power in ourselves can be brought into action only by willing or volition. This is exactly our doctrine; where we have endeavoured to prove, that without the consciousness of actual energy in ourselves, we never could have acquired any notion at all of power from observing the changes which take place among external objects. But if this be so, if the *power*, of which alone we know any thing, can be brought into

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into action only by willing or volition, and if will necessarily implies some degree of understanding, as in us it certainly does, it comes to be a question of the first importance, whether any being which possesses not will and understanding can be possessed of real power, or be the efficient cause of any action. This question we feel ourselves compelled to answer in the negative. If *we* had not will, and that degree of understanding which will necessarily implies, it is evident that we could exert no power, and consequently could have none: for power that cannot be exerted is no power. It follows also, that the power, of which alone we can have any distinct notion, can be only in beings that have understanding and will. Power to produce any effect, implies power not to produce it; and we can conceive no way in which power may be determined to one of these rather than the other in a being that has not will. We grow from infancy to manhood; we digest our food, our blood circulates, our heart and arteries beat; we are sometimes sick and sometimes in health: all these things must be done by the power of some agent, but they are not done by our power. And if it be asked how we know this? the answer is, because they are not subject to our will. This is the infallible criterion by which we distinguish what is our doing from what is not; what is in our power from what is not. Human power can be exerted only by will: and we are unable to conceive any active power to be exerted without will. If, therefore, any man affirms that a being may be the efficient cause of an action which that being can neither conceive nor will, he speaks a language which we do not understand. If he has a meaning, he must take the words *power* and *efficiency* in a sense very different from ours; for the only distinct notion, indeed the only notion which we can form, of real efficiency, is a relation between the cause and the effect similar to that between us and our voluntary actions. It seems therefore most probable, that such beings only as have some degree of understanding and will can possess active power, and that inanimate beings must be merely passive. Nothing which we perceive without us affords any good ground for ascribing active power to any inanimate being; and we can as little conceive such a being possessed of power as we can conceive it capable of feeling pain. On the other hand, every thing which we discover in our own constitution, leads us to think that active power cannot be exerted without will and intelligence; and to affirm that it can, is to affirm what to us at least is a contradiction in terms.

119 An objection obviated.

To this reasoning, which is Dr Reid's*, and which to us appears unanswerable, we have heard it objected, that a man born blind has the same evidence for the non-existence of colour that is here urged for the impossibility of power being exerted without will and understanding. If the objection had not been made by a very acute man; we should have deemed it altogether unworthy of notice; for between the two cases supposed to be similar there is hardly any analogy. A man born blind has no notion whatever of colour. If you describe it to him in the best manner that you can, and refer it to any of the senses which he possesses; if you say that it is the object of feeling, and that by feeling it one may perceive things at the distance of many miles; the blind man has reason to say that you are uttering a proposition which he knows with the utmost certainty cannot possibly be true. But if you tell him that colour is the object of the sense of sight, a sense which he possesses not; that it has not the least resemblance to the objects of the other senses; and that persons endowed with the sense of sight perceive coloured objects at the distance of many miles; the blind man cannot know whether what you say be true or false, because he has no idea or conception of the things of which you speak. This is not the case with respect to power; for every man who has reflected on the operations of his own mind has a very distinct notion of power, and knows perfectly, that to the actual exertion of the only power which he can conceive, will and understanding are necessary. Should it be said that there may be power altogether different from that of which we have a distinct conception, we think it sufficient to reply, that of a thing which cannot be conceived nothing can be either affirmed or denied; that activity exerted without will and understanding ought not to be called an exertion of *power*, because power is the name already appropriated to the attribute of a being by which he can do certain things if he wills; that we can form no notion of a real efficient cause which has not will and understanding, so we have no reason to believe that such a cause any where exists; and to say that power, such as we can conceive, may be exerted without will and understanding, is as great an absurdity as to say that there may be velocity without space.

But if active power, in its proper meaning, requires a subject endowed with will and intelligence, what shall we say of those active powers which philosophers teach us to ascribe to matter, the powers of corpuscular attraction, magnetism, electricity, gravitation, and others? These powers, as they are called, shall be considered when we treat of the nature and source of corporeal motion. In the mean time, it is sufficient to observe, that whatever the agents may be in the operations of nature, whatever the manner of their agency or the extent of their power, they depend upon the first cause, and are all under his control.

Chap. VII. *Of* Truth, *and the different* Sources *of* Evidence.

Sect. I. *Of Truth.*

By pursuing these inquiries in the order which to us appears most natural, we are now led to the contemplation of those faculties of the human mind of which *truth* is properly the object. But what is *truth?* This was a famous question among the Greek sophists; which had been so often agitated, and to which so many absurd answers had been given, that it came at last to be doubted by men of the world whether a satisfactory answer could be given, or indeed whether the matter was worthy of investigation. It is well known, that among the ancient philosophers there was a sect called from their principles *Sceptics*, and from their founder *Pyrrhonians*, who openly avowed their opinion that *truth*, like virtue, is nothing but a name; that all things are equally true, or rather equally doubtful; and that it is in vain for man to hope for certainty in any inquiry in which he can be engaged. Such scepticism

* See Essays on the Active Powers of Man.

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scepticism as this no modern philosopher has professed; but many have had enough of it to make sober men hesitate about defining truth, and even insinuate that of truth no definition can be given. This surely is a mistake. If truth cannot be defined, it still wanders at large and in disguise, and vain must be the pursuit of every man who endeavours to obtain it; he is pursuing he knows not what.

120 Truth defined.

So obvious and so solid is this reflection, that almost every philosopher of merit who has lately written on the nature of evidence has begun his work, if not with a formal definition, with something at least equivalent to a definition of the object of his pursuit. To repeat all these definitions could serve no other purpose than to swell this article to a disproportioned bulk, and to perplex perhaps the mind of the reader. We shall therefore content ourselves with that which is given by Mr Wollaston. "Those propositions (says he) are true which represent things as they are: or, truth is the conformity of those words or signs by which things are expressed to the things themselves." Notwithstanding the objections of a very learned and acute writer (w), this is the best definition of *truth* which we have met with in any language. It is concise and perspicuous. It comprehends all kinds of truth, as well that which is merely mental, the subject of silent contemplation, as that which is communicated either by written language or by the living voice: and it makes truth itself immutable, as depending not upon the arbitrary constitution of this or that individual, or even of the whole human race (x), but upon the nature of things as established by their Almighty Creator.

121 Every proposition either true or false.

According to this definition, every proposition which

(w) Dr Tatham having asked, with a contemptuous air, How imperfect and illogical is the definition of truth given by Wollaston? proceeds, though not to define, to describe or characterise it himself. "Truth (says he) is of the nature and essence of God, like him *incomprehensible* in the whole, and *ineffable* in its sublimer parts. For these and other reasons it cannot admit of an *adequate definition*. And who, in the beginning of his researches, should presume to define that which, after all his longest and best conducted labours, he can only hope partially, and often imperfectly, to comprehend; and of which an important part can neither be *directly* expressed nor *directly* understood? We may indeed esteem ourselves highly favoured by the Author and finisher of all truth, if, at the end of our researches, we shall be able any way to understand, to define, and to apply a few particular portions and detachments of it, and to guard them from ERROR and corruption. When upon a solemn occasion the question was put to our Lord by a Roman governor, *What is TRUTH?* though it was what he fully and perfectly knew, and what he came purposely and professedly to teach, he did not define it. He knew that definition was never the best method of instruction; and that in its common use and application it was seldom the friend of truth. Philosophically viewed, words do not constitute truth; they are only the vocal instruments by which it is communicated, or the written signs by which it is recorded. By an inquirer, therefore, things are to be examined rather than words defined. By a teacher, things are to be conveyed by words in some form or other, which are doubtless to be explained to the understanding if not sufficiently understood before. But *explanation* is one thing, and *definition* quite another. Explanation is the *first* office of a teacher: Definition, if it be good, is the *last* of the inquirer, after the truth be found; and is then the most *advantageously* employed by the teacher, when his previous instructions have prepared him for it. GOD is a mind, and TRUTH is consequently an *attribute* of MIND. To the SUN, declaring at his rising a marvellous instrument, He, by whom all things were made, hath delegated the power of enlightening the *material* system; whilst he hath reserved to HIMSELF the office which is more suitable to his nature, of giving light and knowledge, by his eternal TRUTH, to the *mind* of man. But whether he act through the instrumentality of his creatures, or more *immediately* from himself, he is uniform and consistent in his operations; so that one part of his divine economy is always illustrative of another. As the SUN sheds his *light* over the material creation to be apprehended by the eye, TRUTH is the *light* shed down from heaven to be apprehended by the intellect, given to illumine every subject, natural and moral, corporeal and spiritual, so far as they are qualified by their different natures to convey to the human mind, or rather perhaps so far as the human mind is qualified to receive it from them." *The Chart and Scale of Truth*, vol. I.

This passage, of which some parts are certainly not remarkable for perspicuity, seems to be descriptive, not of *truth* in the common acceptation of the word, but of *all knowledge* human and divine, of which indeed no adequate definition can be given. *Truth*, as here used, seems to be opposed to *ignorance*; as used by Mr Wollaston and others it is opposite to *falsehood*. In this last sense it may certainly be *explained*; if not defined: and if the learned lecturer will allow that Mr Wollaston has given a good *explanation* of the word *truth* as opposed to *falsehood*, we shall not quarrel with him or any man about the propriety of an expression. We have called it a *definition* of truth; because it was so called by the author from whom it is taken.

(x) Dr Beattie, in his elegant essay, has given a definition of truth very different from this, though it is possible that his meaning may be the same with Mr Wollaston's. "I account that to be *truth* (says he) which the constitution of our nature determines us to believe; and that to be *falsehood* which the constitution of our nature determines us to disbelieve." But if truth be really *immutable*, as he teaches or wishes to teach, it must depend upon the nature of things, and not upon the instinctive impulse of any particular constitution. It is always difficult, often impossible, to distinguish between the constitution of our nature, as it came from the hand of God, and the same constitution as it is moulded by arbitrary and capricious associations of our own. A sincere member of the Church of Rome, certainly believes the doctrine of transubstantiation. How he may do so we have already shown. Were all mankind sincere members of that church, it would be said an

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which can be expressed or apprehended is necessarily either true or false, whether its truth or falsehood be perceived or not either by him who hears or by him who utters it. All propositions are either affirmative or negative; but before any thing can with certainty be affirmed or denied of another, we must know those things as they are in themselves, as well as the established use of the signs by which they are expressed. He who affirms or denies without this knowledge, speaks at random, and has no distinct meaning.

122 Every human faculty concerned in the acquisition of truth.

Every faculty which we possess is in some way or other an instrument of knowledge; for we know by our senses, by our memory, and by our intellect. Every one of our faculties, therefore, is concerned in the acquisition of truth, and furnishes the mind with the materials of propositions. These propositions are indeed of various knds; but they are all certainly true or certainly false, though the *certainty* of the truth or falsehood of every one it is not always in our power to perceive.

123 Diversity of belief affects not the truth of what is believed.

When a man affirms that red is a quality inherent in a soldier's coat, he utters a proposition which every one of the vulgar firmly believes to be true, but which every philosopher knows to be false. This diversity of belief, however, affects not the truth of the proposition itself. All mankind know that it is either true or false, independent of them or their perceptions; and it is easy, by a few optical experiments and by an explanation of terms to convince them all, that what they have agreed to call *red* is no quality inherent in external objects, but only a sensation caused by the impulse of certain rays of light reflected from certain objects to the eye of the percipient. The contrariety therefore in this case of vulgar to philosophical belief, does not result from any ambiguity in the nature of truth itself, but from the different means of perception which the clown and philosopher possess.

Again, were a man looking at a red and a green object, to affirm that they are both of the same colour, he would affirm what in one sense may be true, what in another is undoubtedly false, and what in a third may be either true or false. If it be his meaning that the two objects give to him the same sensation, he may know with the utmost certainty that what he says is true; if he mean that they affect all mankind precisely as they affect him, he utters what all mankind with the most absolute certainty know to be false; if he mean that the texture of the two bodies (that particular disposition of parts on their surfaces which makes them reflect certain rays of light and absorb others) is exactly similar, so as that the one must reflect the very same kind of rays with the other, he utters what all mankind must *believe* to be false, though still it is *possible* that what he affirms may be true. This diversity of belief affects not the truth itself. The two objects are what they are by whomsoever perceived, or whether perceived or not; the rays of light reflected by each are what they are, whether they fall upon this, upon that, or upon any eye; and the sensation communicated to this singular man is certainly what he is conscious it is, as those of the rest of mankind are with equal certainty what they are conscious of. This being the case, it is obvious and undeniable, that the organs of sight in this individual of the human race are somehow differently formed from those of other men: and the only question which can occasion a doubt in the mind of the sceptic is, whether his or their eyes be so formed as to represent things falsely? for that by the one or the other things are falsely represented, is as evident as that two contradictory propositions cannot both be true. Now, though, for any thing we know it is certainly possible, as to us it appears not to imply any contradiction, that the eyes of but one man are formed in a manner suitable to their objects, whilst the eyes of all other men are formed to deceive them; yet the contrary is so highly probable, that no man really doubts of it any more than he doubts whether three and two be equal to five.

124 Why some truths are said to be absolutely and others morally certain.

This last proposition is indeed said to express a truth absolutely certain, whilst the former expresses a truth which is called morally certain: not that there is any difference or degrees of certainty in the nature of truths themselves; the only difference is in our power of perceiving them. That three and two are equal to five, is said to be an absolute truth; because we perceive the whole of it as it is in itself, and are convinced that every intelligence from the highest to the lowest who understands the terms in which it is expressed perceives it as we do: whereas of *moral* or *physical* truths, as they are called, we only perceive a part, and may therefore mistake for want of evidence. Thus, in the case of the two objects exhibiting the same colour to one man, whilst they exhibit different colours to all other men, could we see into the objects themselves and comprehend them immediately with our intellect as we comprehend our own ideas, it might, and no doubt would, appear as palpable a contradiction to say that the particular disposition of the parts on their surfaces, which reflect the rays of light, are the same in both, as it is now to affirm that three and two are not equal to five. Between truth and falsehood there is no medium. All truths are in *themselves* equally certain; and to the Supreme Being, who knows the nature of every thing more fully and intimately than we know our own ideas, they all *appear* equally certain: but yet we may without absurdity speak of *probable* truth as well as of *certain* truth, provided always that we make the difference to result, not from the nature of things, but from the power of our understanding, which comprehends the one kind of truth wholly and the other only partially.

125 Why some truths are said to be eternal and necessary, whilst others are considered as temporary and contingent.

There is another division made of truth into that which is eternal and necessary, and that which is temporary and contingent. Though we do not approve of

and thought, "that the constitution of human nature determines men to believe transubstantiation:" a doctrine which, though it is rejected by millions, Pere Buffier has laboured hard to reconcile with common sense. Yet it is certain that the same body cannot be in different places at the same time; and that therefore transubstantiation must be false, though believed by all mankind. Our *believing* any thing does not make it true, nor our *disbelieving* any thing make it false. We must, indeed, *act* according to our belief; but in every instance truth and falsehood would have been what they are, though we had never existed.

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of applying the epithets *temporary* and *eternal* to any thing but real existences, yet as this manner of speaking has been used by all philosophers, we shall give instances of each kind of truth, and endeavour to ascertain in what the distinction consists. "The three angles of a plain triangle are equal to two right angles," is a proposition expressive of a necessary and eternal truth. "The world exists," is a contingent and temporary truth. Here it is obvious, that if both these propositions be true, there is no distinction between them, so far as mere *truth* is concerned; for truth admits not of degrees of comparison. It is however said, that the first proposition depends not upon time, or will, or any thing else; and that the Supreme Being himself could not make it false: whereas it is certainly possible, that he who created the world could annihilate it, and thus reduce what is now a truth to an absolute falsehood. This difference between the two propositions is thought a sufficient ground for calling the former a *necessary* and *eternal* truth, and the latter a *temporary* and *contingent* truth. But is the difference itself real? In the present instance we cannot think that it is: for if the right angles and triangles, which constitute the materials of the former proposition, be real corporeal things, they may be annihilated as well as the rest of the world; and then the truth of the proposition will cease, for there can be neither equality nor inequality between nonentities. If the angles and triangles be merely ideas in the mind of a rational being, it is not to be denied that the proposition must be true, independent of all *will*, whenever those ideas exist, *i. e.* whenever right angles and triangles are *thought upon*; but if all reasonable creatures were to be annihilated, and the Supreme Being never to think of triangles, the proposition would unquestionably cease to be either true or false. The world indeed may be annihilated; but it certainly is not annihilated whilst any one creature exists to contemplate even that which is called *necessary* and *eternal* truth: and therefore whilst any truth exists in a mind not divine, it must be necessarily true that the world exists; for the individual being by which truth is perceived would then constitute the whole world.

But if in a somewhat different manner we compare the former of these propositions with this—"The solar system consists of the sun and at least seven primary planets"—we shall at once perceive the difference between necessary and contingent truths. Both propositions we know to be true at this moment: but there is this difference between them, that a plain triangle can neither actually exist at any period of duration, nor be conceived by any one mind divine or human, of which the three internal angles are not precisely equal to two right angles; whereas the solar system may easily be conceived, and might certainly have been formed, with a smaller number of primary planets rolling round the central fire. This needs no proof; as it is well known, that till very lately we conceived the system to consist of the sun and only six primary planets; and it has been already shown, that whatever we can positively conceive may possibly exist. Thus, then, every proposition of which the contrary is clearly and distinctly perceived to be impossible, is a *necessary* truth; and it may likewise be said to be *eternal*, because at every period of duration it must of necessity when thought upon be perceived to be true: On the other hand, every proposition of which the contrary may be clearly and distinctly conceived, is, if true, only a *contingent* truth, because its contrary might have existed; and it may likewise be called *temporary*, because what might have been false in time past may yet be false in time future.

126 Truth perceived by our rational faculties, which are commonly said to be two, reason and judgement.

Though all our faculties (our senses, our memory, and our intellect) furnish materials for propositions, and are therefore all subservient to the investigation of truth; yet the perception of truth, as it is in itself, is commonly ascribed to our rational faculties; and these have by Locke and others been reduced to two—reason and judgment. The former is said to be conversant about certain truths, the latter chiefly about probabilities.

127 To which some philosophers have added a third faculty, viz. common sense.

Some late philosophers of great merit, dissatisfied with this analysis of the intellect, have added to reason and judgment a third faculty, to which they have given the name of *common sense*, and of which the proper object is such truths as neither admit nor stand in need of evidence. By *common sense* they mean, "that degree of judgment which is common to men with whom we can converse and transact business." Whether the introduction of such a term into metaphysics was proper or improper, we do not think it of importance to enquire. According to this definition of it, which is Dr Reid's, it differs not from the *reason* (x) and *judgment* of Locke; agreeing with the former when its

(x) This is expressly acknowledged by Dr Reid. "It is absurd (says that able and candid writer) to conceive that there can be any opposition between reason and common sense. It is indeed the first-born of reason; and as they are commonly joined together in speech and in writing, *they are inseparable in their nature*. We ascribe to reason two offices or two degrees: The first is to judge of things self-evident; the second to draw conclusions that are not self-evident from those that are. The first of these is the province, and the sole province, of common sense; and therefore it *coincides with reason in its whole extent*, and is only *another name* for one branch or one degree of reason." Pere Buffier talks nearly the same language; but Dr Beattie expresses himself very differently. "That there is a real and essential difference between these two faculties; that common sense cannot be accounted for by being called the *perfection of reason*, nor reason by being resolved into *common sense*; will appear (he thinks) from the followng remarks. 1. We are conscious, from internal feeling, that the energy of understanding, which perceives intuitive truth, is different from that other energy which unites a conclusion with a first principle by a gradual chain of intermediate relations. 2. We cannot discern any necessary connection between reason and common sense." Nay, he says, "That we often find men endued with the one who are destitute of the other:" and he instances dreams and certain kinds of madness where this is the case; adding, that a man who believes himself

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its object is certain truth, and with the latter when it is conversant about probabilities. Nothing indeed is more evident, than that in the assent of the mind to every proposition, some energy of the judgment is exerted; and upon every proposition not self-evident, reasoning of some kind or other must be employed to procure that assent. Instead therefore of perplexing ourselves and our readers with various analyses of the human understanding, or rather with various names to what after all is perhaps but one individual power, it will surely be of more importance to the cause of truth to examine the different sources of evidence by which the assent of the reason, or judgment, or common sense is determined.

Under the article LOGIC it was observed, that *intuition*, *experience*, and *testimony*, are each a sufficient *ground* of *judgment*; but they are not the only grounds. *Consciousness* is certainly one source of evidence, perhaps the most complete of any; and in a low degree, *analogy* is another. Of *consciousness* we have already treated, but of *analogy* we have yet said nothing: and though we might (for an account of *intuition*, *experience*, and *testimony*) refer our readers to the article LOGIC, where they are accurately though concisely explained, we shall, without repeating what has been already said, add a few words on each, as well to complete the present article as to supply the deficiencies of the former.

SECT. II. *Of Intuitive Evidence and Demonstration.*

128 Intuitive evidence, what.

INTUITIVE evidence is that which arises from the comparison of two or more ideas or notions when their agreement or disagreement is perceived immediately, without the intervention of any third idea or notion. Of this kind is the evidence of these propositions: One and four make five*; things equal to "the same thing are equal to one another; the whole is greater than any of its parts;" and in a word, all the axioms in arithmetic and geometry. All these are in reality propositions in which the subject and predicate appear upon comparison to be nothing more than the same thing taken in different views or expressed by different terms. In fact, they are all in some respect reducible to this axiom, "Whatever is, is." We do not say that they are deduced from it; for they have in themselves that original and intrinsic evidence which makes them, as soon as the terms are understood, to be perceived intuitively. And if they be not thus perceived, no deduction of reason will ever confer on them any additional evidence. But though not deduced from the general axiom, they may be considered as particular exemplifications of it; inasmuch as they are all implied in this, that the properties and relations of our clear and adequate ideas can be no other than what the mind clearly perceives them to be.

* Campbell's Philosophy of Rhetoric.

129 Every demonstration a series of propositions intuitively evident.

It may perhaps be thought, that if axioms were propositions perfectly identical, it would be impossible by their means to advance a single step beyond the simple ideas first perceived by the mind. And it would indeed be true, that if the predicate of the proposition were nothing but a repetition of the subject under the same aspect, and in the same or synonymous terms, no conceivable advantage could be made of it for the furtherance of knowledge. Of such propositions as these, for instance, "seven are seven, eight are eight, the three angles of a triangle are the three angles of a triangle, two right angles are two right angles," it is manifest that we could never avail ourselves for the improvement of science: But when the thing, though in effect coinciding, is considered under a different aspect; when that which is single in the subject is divided in the predicate, and conversely; or when what is a whole in the one is regarded as a part of something else in the other; such propositions lead to the discovery of innumerable and apparently remote relations. It is by the aid of such simple and elementary principles that the arithmetician and the algebraist proceed to the most astonishing discoveries. Nor are the operations of the geometrician essentially different: for to this class belong all propositions relating to number and quantity; that is, all which admit of mathematical demonstration. If the truth of a mathematical proposition be not self-evident; in other words, if the subject and predicate do not appear at first sight to be different names for the same thing, another term must be found that shall be synonymous to them both. Thus, to prove that the three internal angles of a right-lined triangle are equal to two right angles, I produce the base of the triangle; and by a very short process I discover that the exterior angle so formed is equal to the two interior and opposite angles. By a process equally plain and short, I perceive that the exterior angle and the interior adjacent angle are equal to two right angles: But I have already seen, that the exterior angle is neither more nor less than the two interior and opposite angles under a different aspect; whence it appears that the three internal angles of the triangle are nothing else than two right angles under a different aspect. In a word, all demonstration is founded on first principles or primary truths, which neither

self made of glass, shall yet reason very justly concerning the means of preserving his supposed brittleness from flaws and fractures." Surely these are strange remarks. Dreams and madness have hitherto been supposed to originate in the imagination, or as it was denominated by the ancient philosophers, the *phantasia*: and when the ideas or forms which are there treasured up are disarranged or absurdly compounded, a dreaming sane man or a waking madman, if he reason at all, must reason from absurd principles; not, however, through any defect of common sense, but from a disorder in that region of the brain, upon which the phantasia more immediately depends. Of his first remark, we can only say, that to us it appears to be the reverse of truth. In every proposition which admits of demonstration, *we* are conscious that the conclusion is united with the first principle by a repetition of the very same energy of the understanding which perceives intuitive truth. That this is the case in every one of Euclid's demonstrations, we appeal to every mathematical reader; and why it must be so, we shall by and by endeavour to evince.

Of Intuitive Evidence and Demonstration.

neither admit nor stand in need of proof, and to which the mind is compelled to give its assent by a bare intuition of the ideas or terms of which these primary truths are composed.* Nothing is susceptible of demonstration, in the rigid sense of the word, but general, necessary, and eternal truths; and every demonstration is built upon intuition, and consists in a series of axioms or propositions of the very same kind with the first principle or truth from which the reasoning proceeds. That propositions formerly demonstrated are taken into the series, doth not in the least invalidate this account; inasmuch as these propositions are all resolvable into axioms, and are admitted as links in the chain; not because necessary, but merely to avoid the useless prolixity which frequent and tedious repetitions of proofs formerly given would occasion. But it is obvious that such truths only as result from the comparison of ideas and notions are necessary; and of course that such truths only are capable of strict demonstration. The truths which relate to real existences are all contingent, except that which affirms the existence of the Supreme Being, the Parent of all truth.

The mathematical sciences, categorical logic, and that part of metaphysics which demonstrates the being of God, are therefore the only branches of human knowledge which admit of strict demonstration. The longest demonstration in the mathematical sciences may be traced to this general and necessary truth, "Whatever is, is," or to some particular exemplification of it: the longest train of categorical syllogisms terminates in this general principle, "What is affirmed or denied of a whole *genus*, may be affirmed or denied of all the *species* and all the *individuals* belonging to that genus:" and the metaphysical demonstration of the being of God rests upon this foundation, "Whatever had a beginning, had a cause." That these are truths absolutely certain, which can neither be proved nor called in question, every man may be satisfied, merely by attending to the ideas or notions which the terms of each proposition express. The two first are merely identical propositions, of the truth of which no man has ever pretended to doubt; and though the last is not identical, it is a necessary and self-evident truth, as its contrary implies, that in the same thing there is power and no power, change and no change, action and inaction, at the same instant.

130 It is by intuition that we acquire all our notions of relation.

Before we dismiss the subject of intuition, it may not be improper to observe, that it is by this faculty or power of the mind contemplating its ideas, and comparing one idea with another, that we acquire all our notions of relation; such as *identity* and *diversity*, *resemblance*, *coexistence*, relations of *space* and *time*, relations of *quantity* and *number*, of a *cause* to its *effect*, and many more which it would be useless as well as tedious to enumerate.

Sect. III. *Of Experience and Analogy.*

131 Experience, the result of repeated observations.

It has been just observed, that intuition and demonstration are applicable only to general and necessary propositions, of which the contrary are not only false, but absurd and impossible. The great business of life, however, is with facts and contingent truths, which admit not of demonstration, but rest upon other evidence. The senses, external and internal, are the inlets to all our knowledge of facts; and the memory is the storehouse where that knowledge is preserved. Of what a man sees or feels, he can at the instant of seeing or feeling entertain no doubt; and whilst the ideas of what he has seen or felt, with all their associated circumstances, remain vivid and distinct in his memory, he is conscious that he possesses so much real knowledge. But all our knowledge, as it is derived from the senses, is of particular facts or particular truths; and the man who has in certain circumstances observed one particular phenomenon, for the existence of which he perceives no *necessity*, has not sufficient ground to conclude, that in similar circumstances similar phenomena will always occur. Milton, who surpassed the greater part of his contemporaries in philosophical science almost as far as he has surpassed all succeeding poets in the sublimity of his genius, represents Adam, when first falling asleep, as under apprehensions that he was about to sink into his original state of insensibility:

Of Experience and Analogy.

——————"Gentle sleep
"First found me, and with soft oppression seiz'd
"My drowsed sense, untroubled; though I thought
"I then was passing to my former state
"Insensible, and forthwith to dissolve."

Apprehensions similar to these would take place in his mind when he first perceived that darkness had overspread the earth. In his circumstances, he could have no ground to expect that the sun when once set would rise again to relume the world, as he had not then experienced the alternate succession of light and darkness, and probably knew not whence light proceeds. After some time, however, having observed day and night regularly to succeed each other, these two appearances, or the ideas of them, would be so associated in his mind, that each setting sun would suggest the idea of next sun-rising, and lead him to expect that glorious event with the utmost confidence. He would then consider the alternate succession of day and night as a law of nature, which might be affirmed in a proposition expressive of a certain truth.

132 Is the only evidence that we have for all the general truths in physics, even those which we think intuitively certain.

This continued observation of the same event happening in the same or similar circumstances, is what we call *experience*; and it is the only evidence which we have for all the general truths in physics, even for those which we are apt to think intuitively certain *. Thus, that *milk* is white, and that *gold* is yellow, are supposed to be universal and necessary truths: but for any thing that we know, they may be particular truths; and they are certainly contingent, as the contrary to either of them may be supposed without absurdity. We have indeed always observed the milk of animals of every species *white*; and therefore the idea of *white* becomes a necessary part of our *idea* of the substance milk, of which we call whiteness an essential property. This, however, respects only the milk of those animals with which we are acquainted. But since the milk of all the animals with which we are acquainted, or of which we have heard, is white, we can have no reason to suspect that the milk of any new and strange animal is of any other colour. Also, since, wherever there has been the specific gravity, ductility, and other properties of *gold*, the colour has always been *yellow*; we conclude that these circumstan-

* Campbell's Philosophy of Rhetoric; and Priestley's Remarks on the Drs Reid, &c.

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ces are necessarily united, though by some unknown bond of union, and that they will always go together.

133 Difference between experience and analogy.

The proper proof, therefore, of such universal propositions as "that milk is white," "that gold is yellow," or "that a certain degree of cold will freeze water," consists in what is called an induction of *particular facts* of precisely the same nature. Having found, by much and various experience, that the same events never fail to take place in the same circumstances, the *expectation* of the same consequences from the same previous circumstances is necessarily generated in our minds; and we can have no more suspicion of a different event than we can separate the *idea* of *whiteness* from that of the other properties of *milk*.—When the previous circumstances are precisely the same, we call the process of proof by the name of *induction*, and expect the event from *experience*: but if they be not precisely the same, but only bear a considerable resemblance to the circumstances from which any particular appearance has been found to result, we call the argument *analogy*; and it is stronger in proportion to the degree of resemblance in the previous circumstances. Thus the milk of all the cows that we have seen, or upon which we have made the experiment, having been found nourishing, we confidently expect that the milk of all other cows will prove nourishing likewise; and this confidence of expectation is the result of uniform experience. But if, from having found the milk of all the animals with which we are acquainted to be nourishing, however different the nature of these animals; we infer that the milk of any strange animal will likewise be nourishing; the inference is drawn by analogy, and by no means carries with it the conviction of experience. A proof from *real* experience can leave no doubt in the mind (B); an argument from analogy always must. In the one case, we only infer that two events of precisely the same nature and in precisely the same circumstances have been produced by the same kind of cause; in the other, we infer that two events similar in most respects, though for any thing that we know dissimilar in others, have been produced by the same kind of cause; and it is obvious that between these cases the difference is great.

134 The evidence of analogy inferior to that of experience,

Thus, after having observed that all the projectiles to which we have paid any attention—a stone thrown from the hand, a ball from a gun, and an arrow from a bow—describe a certain curve, and are impelled in that curve by two powers acting in different lines of direction which form with each other a certain angle, we infer that all projectiles which on the surface of the earth describe the same curve are impelled by the same or similar powers acting in the same or similar lines of direction. This inference is the result of experience, and carries with it the fullest conviction to the mind. But when, from having observed that the curves described by the planets are of the same kind with those described by projectiles on the earth, Sir Isaac Newton inferred that these vast bodies are impelled in their orbits by forces of the very same kind, and acting in the same manner with the forces which impel a ball from a cannon or an arrow from a bow, his argument was founded only on analogy; and even that analogy is very remote. We know by experience that all projectiles which fall under our immediate cognisance are of the very same kind and in the very same circumstances; that every one of them has a tendency, from whatever cause, to the centre of the earth, and is preserved from falling by the force of projection; we know likewise that they are all moved thro' the medium of the atmosphere, which at the surface of the earth is considerably dense, and that a dense medium must occasion much resistance: But we do not *know* that the planets have a tendency to the centre of the sun, that they are preserved from falling into that luminary by a projectile force, or whether they move through a *medium* or *in vacuo*: so that we are not *certain* that the motion of the planets is perfectly similar to that of terrestrial projectiles in any other circumstance than the form of the curve which they all describe; and from this single case of coincidence no inference can be drawn which carries to the mind absolute conviction.

When a man reasons from *experience*, he infers, that what has uniformly happened hitherto, will happen always in the very same circumstances; or that what is known to be the cause of *various phenomena of the same kind* is the cause of every other phenomenon in *all respects* similar to these. Such an inference is founded on the united and complete evidence of sense, memory, and reason. When a man reasons from *analogy*, he infers, that what has *generally* happened hitherto, will

(B) We say from *real* experience; because what is often taken for *experience*, and to human eyes has that appearance, is in fact nothing more than *analogy*. Thus a physician may have prescribed to ninety-nine patients labouring under the same disease the same remedy, and always with the same success. If so, he will think that he has experience of its utility, and will prescribe it again with the fullest confidence. Yet in this case he may be disappointed; for though the medicine be the same and the disease the same, there may be something in the constitution of the hundredth patient so different from that of the ninety-nine, that what was salutary to them may be pernicious to him. This does not detract from the evidence of experience: it only shows, that the circumstances of the case in which the medicine failed were different from those in which it succeeded. In such conclusions as are founded on a complete induction and uniform experience, every man expects the event with the last degree of assurance, and regards his past experience as a full *proof* of the future existence of that event: In other cases, where experience has been variable—or apparently variable—he knows that the induction has been incomplete, and therefore proceeds with caution. He weighs the opposite experiments; takes as complete a view as he can of the circumstances in which they were made; considers which side is supported by the greater number of experiments, and inclines to that side with doubt and hesitation. And when at last he fixes his judgment, the evidence exceeds not what is called *probability*. All probability, then, supposes an opposition of experiments and observations, where the one side is found to overbalance the other, and to produce a degree of evidence proportioned to the superiority

Of Testimony.

will happen again in circumstances *nearly similar*; or that what is known to be the cause of various phenomena of the same kind, is the cause of other phenomena in *some respects* similar to these. This inference is likewise founded on the united evidence of sense, memory, and reason: but here the evidence of sense is not complete, and it can be strengthened only by finding more facts of the same or of a similar nature.

Sect. IV. *Of Testimony.*

135 Mankind ready to believe the testimony of each other.

The last source of evidence which we proposed to consider is *testimony*, or the report of men concerning events which have fallen under the observation of their senses. That we are all ready to believe the information which we receive from the testimony of our fellow creatures is undeniable; and indeed without such belief, every man's knowledge of facts and events would be confined to those only of which he himself had been a personal witness. In that case, no man who had not travelled would believe that there are such cities as Rome and Constantinople; and no man whatever could now believe that such heroes as Hannibal and Cæsar had ever existed.

Between words and things there is no natural connection; and though we are all accustomed to give to things the names by which they are known in the language that we speak, and to express their mutual relations by the words appropriated for that purpose; yet it is obviously impossible to denote one thing by the name of another, and to express by words relations that have no existence. This being the case, it may be asked upon what principle we give credit to human testimony? To this question various answers have been given, which have produced much controversy on one of the most important subjects which can employ the mind of man.

136 The reason assigned by Hume for this propensity.

"We may observe (says Mr Hume*), that there is no species of reasoning more common, more useful, and even necessary to human life, than that which is derived from the testimony of men and the reports of eye-witnesses and spectators. The species of reasoning perhaps one may deny to be founded on the relation of cause and effect. I shall not dispute about a word. It will be sufficient to observe, that our assurance in any argument of this kind is derived from no other principle than our observation of the veracity of human testimony, and of the usual conformity of facts to the reports of witnesses. It being a general maxim that no (A) objects have any discoverable connection together and that all the inferences which we can draw from one to another are founded merely on our experience of their constant and regular conjunction; it is evident that we ought not to make an exception to this maxim in favour of human testimony, whose connection with any event seems in itself as little necessary as any other. Were not the memory tenacious to a certain degree; had not men commonly an inclination to truth, and a principle of probity; were they not sensible to shame when detected in falsehood: Were not these, I say, discovered by *experience* to be qualities inherent in human nature, we should never repose the least confidence in human testimony. And as the evidence derived from witnesses and human testimony is founded on past experience, so it varies with the experience, and is regarded either as a *proof* or *probability*, according as the conjunction between any particular kind of report and any kind of object has been found to be constant or variable. There are a number of circumstances to be taken into consideration in all judgments of this kind; and the ultimate standard by which we determine all disputes that may arise concerning them, is always derived from experience and observation. The reason why we place any credit in witnesses and historians, is not derived from any *connection* which we perceive *à priori* between testimony and reality, but because we are accustomed to find a conformity between them. But when the fact attested is such a one as has seldom fallen under our observation, here is a contest of two opposite experiences; of which the one destroys the other as far as it goes, and the superior can only operate on the mind by the force which remains. The very same principle of experience which gives us a certain degree of assurance in the testimony of witnesses, gives us also, in this case, another degree of assurance against the fact which they endeavour to establish; from which contradiction there necessarily arises a counterpoise, and mutual destruction of belief and authority."

137 confuted, and.

This account of the origin of faith in testimony has been controverted with much success by the Doctors Campbell and Reid. "That the evidence of testimony is derived solely from experience (says the former of these writers §), is at least not so incontestable a truth as Mr Hume supposes it; that, on the contrary, testimony hath a natural and original influence on belief antecedent to experience, will, I imagine, easily be conceived. For this purpose, let it be remarked, that the earliest assent which is given to testimony by children, and which is previous to all experience, is, in fact, the most unlimited; that by a gradual experience of mankind, it is gradually contracted, and reduced to narrower bounds. To say, therefore, that our diffidence in testimony is the result of experience, is more philosophical, because more consonant to truth, than to say that our faith in testimony has this foundation. Accordingly, youth, which is unexperienced, is credulous; age, on the contrary, is distrustful. Exactly the reverse would be the case were this author's doctrine just." This is a complete confutation of the reasoning of Mr Hume: but in order to prevent all cavilling, it is to be wished that the very acute author had explained more fully what he means by saying, that testimony hath a *natural* and *original* influence on belief; for these words may be taken in different senses, in one of which what he affirms is true, and in another false.

* Essay on Miracles.

§ Dissertation on Miracles, and The Philosophy of Rhetoric.

Dr

(A) Is there then no discoverable connection between a tree and the field in which it grows; between a man and his cloaths; between an author and his work; between a sceptic and paradoxes? Surely all these are correlaries, and necessarily suggest the ideas of each other.

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§ Inquiry into the Human Mind, &c.

Dr Campbell's omission is amply supplied by Dr Reid, who gives § the following account of testimony, and of the credit which it obtains. "The wise and beneficent Author of nature, who intended that we should be social creatures, and that we should receive the greatest and most important part of our knowledge by the information of others, hath, for these purposes, implanted in our nature two principles that tally with each other. The first of these principles is a propensity to speak truth, and to use the signs of language so as to convey our real sentiments. This principle has a powerful operation even in the greatest liars; for where they lie once, they speak truth a hundred times. Truth is always uppermost, and is the natural issue of the mind. It requires no art or training, no inducement or temptation, but only that we yield to a natural impulse. Lying, on the contrary, is doing violence to our nature, and is never practised even by the worst men without some temptation. Speaking truth is like using our natural food, which we would do from appetite, although it answered no end; but lying is like taking physic, which is nauseous to the taste, and which no man takes but for some end which he cannot otherwise attain.—When we are influenced by any motive, we must be conscious of that influence, and capable of perceiving it upon reflection. Now, when I reflect upon my actions most attentively, I am not conscious that in speaking truth I am influenced on ordinary occasions by any motive moral or political. I find that truth is always at the door of my lips, and goes forth spontaneously if not held back. It requires neither good nor bad intention to bring it forth, but only that I be artless and undesigning. There may indeed be temptations to falsehood, which would be too strong for the natural principle of veracity, unaided by principles of honour or virtue; but where there is no such temptation, we speak truth by *instinct*. By this instinct, a real connection is formed between our words and our thoughts; and thereby the former become fit to be signs of the latter, which they could not otherwise be."

Such is the account which Dr Reid gives of the truth of human testimony: and he adds, that there is another original principle implanted in us by the Supreme Being, to tally with it, viz. a disposition to confide in the veracity of others, and to believe what they tell us. "This (he says) is the counterpart to the former; and as that may be called the *principle of veracity*, we shall, for the want of a more proper name, call this the *principle of credulity*. It is unlimited in children, until they meet with instances of deceit and falsehood; and retains a very considerable degree of strength through life."

It is ever with extreme reluctance that we controvert the opinions of this able writer; and that reluctance cannot be lessened in the present instance, when we are conscious that great part of what he says is unanswerable. That truth is always at the door of the lips; that it requires no effort to bring it forth; that in ordinary cases men speak truth uninfluenced by any motive moral or political; that the greatest liars speak truth a hundred times where they lie once; and that lying is never practised by the worst men without some temptation, are positions which daily experience renders it impossible to question: But notwithstanding this, we do not think that truth is spoken by an *instinctive* principle; because it is inconceivable that instinct should teach the use of arbitrary and artificial signs, such as the words of every language undoubtedly are; or that between such signs and ideas any *instinctive* connection should ever be formed. "Truth (as we have defined it) is the conformity of those words or signs by which things are expressed, to the things themselves;" and things themselves are what they are, independent of us, our instincts, and perceptions. When we have precise and adequate ideas of objects, and when those ideas are related to one another as the objects themselves are related, we are in possession of mental truth; and in this case there is a *real* and *natural* connection between the signs and the things signified: for we cannot frame original and simple ideas which have no archetype in nature; nor can *one* object, distinctly perceived, generate in our minds the ideas that are generated by *other* objects. Here external things are the objects, and ideas are the signs, which, when they are in conformity to the things signified by them, constitute truth.

138 The true reason assigned.

But in human testimony, the ideas in the mind of the speaker are the things signified, and the words of language are signs by which they are expressed; and when these things and signs are in conformity to each other, the words uttered express so much truth.—Now, though in this case there is no *natural* connection between the sign and the thing signified, yet it is obvious, that without a violent effort of the speaker to the contrary they must always be in conformity with each other: because, in every language, there are words appropriated for the purpose of denoting every idea and relation which can be expressed; and in the mind of every man these ideas, relations, and *words*, have been constantly associated from the time that he learned to speak. So intimate is this association, and so impossible to be broken, that whoever will pay sufficient attention to the operations of his own mind, will find that he *thinks*, as well as *speaks* in some language; and that in cogitation he supposes and runs over, silently and habitually, those sounds which in speaking he actually utters (B). If this be so, it is impossible that a man without some effort should ever speak any thing but truth: for the *ideas* of what he has seen or heard, &c. are not of his manufacture;

(B) This seems to have been *Plato's* opinion; for he calls *thinking* λογον ον αυτη προς αυτην ἡ ψυχη δι εξερχεται, περι ὧν αν σκοπη, "the language by which the soul explains itself to itself when it considers any thing." And *Plotinus* says, ο εν φωνη λογος μιμημα του εν ψυχη, "the vocal words are an imitation of those of the soul." To say that vocal words are an imitation of those of the soul, is to speak inaccurately, and to reverse the process of association; but it affords sufficient evidence, that in the opinion of Plotinus men think as well as speak in words.

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nufacture; they are generated by external objects: and till they be effaced from the memory, they must always, by the law of association, make their appearance there with all their mutual relations, and in their proper dress. In the very act of learning to speak, we necessarily learn to speak the *truth*: for were we not to employ words exactly as they are employed by those with whom we converse, our language (if language it might be called) would be unintelligible; and we could neither declare our wants nor ask relief with any hopes of success. *Children* beginning to speak, may indeed utter untruths without any motive, and merely from mistake; because the ideas and words of children have neither been long nor closely associated: but it is impossible that a *man*, however wicked, should habitually and without motives lie on ordinary occasions, unless the fundamental principles of his nature have been totally altered; unless his brain has been disordered by disease; unless his ideas have been disarranged, and all his original associations broken.

We know indeed by woful experience, that immoral men occasionally utter falsehoods with a view to deceive. But on these occasions they are influenced by some motive either of hope or terror: the falsehood is always uttered with an effort: and so strong is the association between words and ideas, that the truth will at times break out in spite of all their endeavours to suppress it; so that the end or middle of a false narrative, if it be of any length, is commonly inconsistent with the beginning. We entertain a suspicion concerning any matter of fact, when those who relate it contradict each other—when they are but few in number, or of doubtful character—when they have an interest in what they affirm—when they deliver their testimony with hesitation—or, on the contrary, with too violent asseverations; because these are circumstances which we have generally experienced to accompany false witness. It is likewise with reluctance that we admit a narrative of events entirely different from every thing which hitherto we have seen or heard; because we may not be certain that the narrator is not under some influence to deceive us in matters concerning which we have nothing but his testimony on which to ground our judgment. But in every case where the fact recorded is in itself possible, and attributed to an adequate cause; where a competent (c) number of witnesses had sufficient means of information, and are certainly under no inducement to deceive; testimony is complete evidence, however extraordinary the fact may be; because no fact which is known to have an adequate cause can be so incredible, as that a number of men of sound understandings should act contrary to the fundamental principles of human nature, or be able, if so disposed, to dissolve associations which had been formed in the mind of each from his infancy, and form new ones, all agreeing exactly with one another, but all contrary to truth.

Part II. Of Body with its Adjuncts.

Chap. I. *Of the* Composition *of* Bodies; *or, of* Matter *and* Form.

HITHERTO we have contemplated only the powers of our own minds by which we acquire a stock of ideas, and the various operations of the intellect upon those ideas, as treasured up in the memory or imagination. In the course of the inquiry we have found, that every idea and notion which we have was suggested by something independent of us; and in order to discover what those things are, we have investigated the nature of each sense, as it is by the senses only that we have any communication with the external world. By touch we perceive heat and cold, hardness and softness, figure, solidity, motion, and extension; by the organ of smell, we perceive odours; by the tongue and palate, tastes; by the ear, sounds; and by the sight, colours. We have likewise seen, that heat and cold, odours, tastes, sounds, and colours, are mere sensations which have no existence but while they are perceived. On the other hand, hardness and softness, figure and solidity, motion and extension, are neither sensations, nor like sensations; but are conceived to be something external and independent of us, and to be the causes of certain sensations. Even of heat and cold, odours, tastes, sounds, and colours, we know with certainty that there is some cause independent of our faculties, which may operate in a desart wilderness as well as in a populous city, though, for want of sentient beings to operate upon, it cannot in the wilderness produce the same effects as in the city.

139 Of things perceived by the senses the greater part always united.

Of things perceived by the senses we find the greater part always united; for when a man perceives a piece of sealing-wax, if he makes use of all his senses, he perceives at once cold, taste, colour, hardness, roughness or smoothness, figure, solidity, motion or rest, and extension. That the powers or qualities, which in this instance produce the sensations of heat or cold, taste, odour, and colour, are so united to the hardness, figure, solidity, and extension of the wax, as that they cannot exist alone, is evident; because it is impossible to remove any one of these things, or to conceive it removed, without removing with it all the rest

(c) Should it be asked what number we call competent, we beg leave to say, that it will be greater or less according to circumstances. In cases where they are not liable to the deceptions of sense, two men of integrity and intelligence deserve equal credit with two thousand; but where there is particular occasion for good organs, whether of sight, hearing, or touch, the greater the number the greater is our security. To this must be added, that as one man is influenced by that which to another would be no motive, a great number of witnesses concurring in the same testimony is always an additional security that they are not under the influence of any latent bias.

Of the Composition of Bodies.

rest. What then is the bond of this union? Do these things necessarily accompany one another, so as that one of them cannot exist without bringing all the rest along with it? No; there is no necessary connection among them: for by the operation of fire the wax may be rendered liquid, when the *hardness* and *cold* are gone, tho' every thing else remains the same, or nearly the same, as it was before. By a still further operation of fire the appearance may be entirely changed; and that which was formerly a piece of hard red wax, may be reduced to smoke and ashes, in which there is neither hardness, colour, odour, nor figure; at least there is not in the smoke and ashes *such* hardness, colour, odour, or figure, as was in the wax. The solidity and extension, however, remain; for we perceive ashes and smoke, to be extended and solid as much as wax or an adamant; nor is it possible to do any thing with the wax, or with any other sensible object, which shall deprive it of extension or solidity.

140 Some of these things termed accidents, and why.

Thus, then, extension and solidity may exist and be perceived when separated from hardness, colour, and odour; but none of these can exist, or be conceived to exist, independent of extension and solidity. Hardness, colour, odour, taste, and figure, or the things which suggest these notions to us, have with great propriety been termed accidents or qualities; because they cannot exist or be conceived to exist by themselves, but require for their support one common subject. Extension and solidity can exist independent of them, but they cannot exist independent of solidity and extension.

141 Things perceived by the senses, qualities which inhere in a subject called matter.

Is then solidity the basis of these qualities, so that they necessarily result from it? No; there are many things solid and extended which are neither hard, nor coloured, nor odorous, nor sapid; which could not be if these qualities were the necessary effect of solidity. Besides, all mankind conceive of solidity and extension as qualities of something else; for we never say that solidity is extended or coloured, or hard or odorous, but that something solid has these qualities: whence it is evident that we consider solidity as a quality itself. In what then does solidity and all the other sensible qualities inhere, since they cannot exist separately and do not support each other? This is a question which modern philosophers pretend not to answer: but some of the ancients were not so modest. Aristotle and his followers resolved every bodily substance into *matter* and *form*, making matter the basis or *substratum*, and under form comprehending all sensible qualities.

As attempts have been lately made to revive this philosophy, it may not be improper to give a short view of the doctrine of *matter* and *form*, if it were only to discover whether the speculations of Aristotle and his adherents on this subject deserve to be prefered to those of Newton and Locke.

The most perspicuous, and by far the most elegant writer among the moderns who has adopted the ancient philosophy, is Mr Harris; and lest we should be accused by others of doing injustice to a subject above the reach of ordinary comprehension, we shall transcribe so much of what he has said of *matter* and *form* in his philosophical arrangements as seems necessary to make our readers understand his meaning as far as it is intelligible.

142 The Peripatetic doctrine concerning matter.

"Matter (says this writer) is that elementary constituent in composite substances which appertains in *common* to them all, without distinguishing them from one another. Every thing generated or made, whether by nature or art, is generated or made out of something else; and this something else is called its subject or matter. Such is iron to the saw; such is timber to the boat. Now this *subject* or *matter* of a thing being *necessarily previous* to that thing's existence, is *necessarily different* from it, and *not the same*. Thus iron, as iron, is not a saw; and timber, as timber, is not a boat. Hence, then, one character of every *subject* or *matter*, that is, the character of *negation* or *privation*. [He means *negation* or privation of what is to be made out of it.]

143 Which is described as destitute of every attribute or quality.

"Again, though the *subject* or *matter* of a thing be not that thing, *yet*, were it incapable of becoming so, it could not be called its subject or matter. Thus iron is the *subject* or *matter* of a saw; because, though *not* a saw, it may still *become* a saw. On the contrary, timber *is not* the subject or matter of a saw; because it not only (as timber) is no saw, but can never be made one from its very nature and properties. Hence, then, besides *privation* another character of every *subject* or *matter*, and that is the character of *aptitude* or *capacity*. [He means aptitude or capacity to be that which is made out of it.]

"Again, when one thing is the *subject* or *matter* of *many* things, it implies a *privation* of them *all*, and a *capacity* to them *all*. Thus iron being the subject or matter of the saw, the axe, and the chissel, implies *privation* and *capacity* with respect to *all three*. Again, we can change a saw into a chissel, but not into a boat; we can change a boat into a box, but not into a saw. The reason is, there can be no change or mutation of one thing into another where the two changing beings do not participate the same matter (D). But even here, were the boat to moulder and turn to earth, and that earth by natural process to metallise and become iron; through such progression as this we might suppose even the boat to become a saw. Hence therefore it is, that *all change* is by immediate or mediate participation of the *same matter*. Having advanced thus far, we must be careful to remember, first, that every *subject* or *matter* implies, as such, *privation* and *capacity*; and next, that *all change* or *mutation* of beings into one another is *by means of their participating the same common matter*. This we have chosen to illustrate from works of art, as falling more easily under human cognisance and observation. It is, however, no less certain as to the productions of nature, though the superior subtlety in these renders examples more difficult. The question then is, whether in the world which we inhabit, it be not admitted from experience, as well as from the confession of all philosophers, that substances

(D) In a note he says: This reasoning has reference to what the ancients called υλη προσεχης, *the immediate matter*, in opposition to υλη πρωτη, *the remote* or *primary matter*.

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substances of every kind (E), whether natural or artificial, either immediately or mediately, pass into one another; and whether, in that case, there must not be some one *primary matter* common to *all things*. I say some *one primary matter*, and that common to *all things*, since without some *such* matter *such mutation* would be wholly impossible. But if there be some *one primary matter*, and that *common to all things*, this *matter* must imply, not (as particular and subordinate matters do) a *particular* privation and a *particular* capacity, but, on the contrary, *universal* privation and *universal* capacity. If the notion of such a being appear strange and incomprehensible, we may farther prove the *necessity* of its existence from the following considerations: Either there is no such general change as here spoken of; which is contrary to fact, and would destroy the sympathy and congeniality of things: Or, if there be, there must be a matter of the character *here* established; because without it (as we have said) such change would be *impossible*. Add to this, however hard *universal* privation may appear, yet had the *primary matter*, in its proper nature, any one particular attribute, so as to prevent its *privation* from being unlimited and universal, such *attribute would run through all things*, and be conspicuous in all. If it were white, all things would be white; if circular, they would be circular; and so as to other attributes; which is contrary to fact. Add to this, that the *opposite* to such attribute could *never* have existence, unless it were possible for the same thing to be at *once* and in the same instance both white and black, circular and rectilineal, &c. since this inseparable attribute would necessarily be *every where*; because the *matter*, which implies it, is itself *every where*, at least may be found in all things that are generated and perishable.

144 And to be apprehended only by abstraction and analogy.

"Here then we have an idea (such as it is) of that singular being ὑλη πρωτη, the *primary matter*; a being which those philosophers who are immerged in sensible objects know not well how to admit, though they cannot well do without it; a being which flies the perception of every *sense*, and which is at best, even to the *intellect*, but a negative object, no otherwise *comprehensible* than either by *analogy* or *abstraction*. We gain a glimpse of it by *abstraction*, when we say that the *first matter* is *not* the lineaments and complexion which make the beautiful face; *nor yet* the *flesh* and *blood* which make those lineaments and that complexion; *nor yet* the liquid and solid aliments which make that flesh and blood; *nor yet* the simple bodies of earth and water which make those various aliments; but *something*, which being *below* all these, and supporting them all, is yet *different* from them all, and essential to their existence. We obtain a sight of it by *analogy*, when we say, that as is the brass to the statue, the marble to the pillar, the timber to the ship, or any one *secondary matter* to any one *peculiar form*; so is the *first* and *original matter* to all *forms in general*."

Such is the doctrine of the Peripatetics concerning the *primary matter*, or the basis of bodily substances. We forbear to make any remarks upon it till we have seen what they say of *form*, the other essential part of every body; for what is meant by *matter* and *form* will be most completely seen when they are viewed together.

145 The peripatetic doctrine concerning form.

"Form (says the same elegant writer) *is that elementary constituent in every composite substance, by which it is* DISTINGUISHED, *and* CHARACTERISED, *and known, from every other*. But to be more explicit: The *first* and most simple of all *extensions* is a *line*: this, when it exists, united with a *second* extension, makes a *superficies*; and these two, existing together with a *third*, make a *solid*. Now this *last* and *complete* EXTENSION we call the *first* and *simplest* FORM; and when this *first* and *simplest form* accedes to the *first* and *simplest matter*, the union of the two produces *body*; which is for that reason defined to be *matter triply extended*. And thus we behold the rise of *pure* and original *body* (F). It must be remembered, however, that *body*, under this character, is something *indefinite and vague*, and scarcely to be made an *object* of *scientific contemplation*. It is necessary to this end that its extension should be *bounded*; for as yet we have treated it without such regard. Now, the *bound* or *limit* of *simple body* is *figure*; and thus it is that *figure*, with regard to *body*, becomes the next *form* after *extension*.

146 The three original forms which added to matter, constitute body physical.

"But though the *boundary* of body by *figure* is one step towards rendering it *definite* and *knowable*, yet is not this sufficient for the purposes of nature. It is necessary *here*, that not only its *external* should be duly bounded, but that a suitable regard should likewise be had to its *internal*. This *internal adjustment*, disposition, or *arrangement* (denominate it as you please), is called ORGANIZATION, and may be considered as the *third* form which appertains to body. By its accession we behold the rise of BODY PHYSICAL OR NATURAL; for every such body is some way or other *organized*. And thus may we affirm, that these *three*, that is to say, *extension*, *figure*, and *organization*, are the *three original forms* to *body physical* or *natural*; *figure* having respect to its *external*, *organization* to its *internal*, and *extension* being common both to one and to the other. It is more than probable, that from the variation in these *universal* and (as I may say) *primary forms*, arise most of those *secondary* forms usually called *qualities sensible*, because they are the proper objects of our several sensations. Such are roughness and smoothness, hardness and softness; the tribes of colours, savours, odours; not to mention those powers of character more *subtle*, the powers electric, magnetic (G), medicinal, &c.

"Here

(E) He must mean only bodily substances; for it is not admitted by such philosophers as make a distinction between mind and body, that the one ever passes into the other.

(F) "Original body (he says), when we look *downward*, has reference to the *primary matter*, its substratum: when we look *upwards*, it becomes itself a *matter* to *other things*; to the *elements*, as commonly called, air, earth, water, &c. and in consequence to all the variety of *natural productions*."

(G) That it is from the *extension*, *figure*, and *organization* of bodies, that their *medicinal* powers arise, seems to be undeniable; for medicines operate by contact: but it is not so clear that the same *forms*, to use the author's language, are the source of *magnetical* powers. If the magnet be surrounded with an atmosphere extending to a certain distance, such may be the case; but if not, the author's conjecture must be ill founded. See MAGNETISM.

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"Here therefore we may answer the question, how *natural* bodies are *distinguished*. Not a single one among them consists of *materials in chaos*, but of materials wrought up after the most exquisite manner, and that conspicuous in their *organization*, or in their *figure*, or in *both*.—As therefore every *natural body* is distinguished by the *differences* just described, and as these *differences* have nothing to do with the *original matter*, which being every where similar can afford no distinction at all; may we not here infer the expediency of ESSENTIAL FORMS, that every *natural substance* may be essentially *characterised?* These *forms*, though they differ from matter, can yet *never subsist without it;* but *united* with it, they help to produce every *composite* being, that is to say, in other words, every *natural substance*, in the visible world. It must be remembered, however, that it is the FORM in this union which is the *source of all distinction*. It is by *this* that the *ox* is distinguished from the *horse*, not by that grass on which they subsist, the *common matter* to both. To which also may be added, that as figures and sensible qualities are *the only objects of our sensations*, and these are all *parts* of *natural form;* so therefore (contrary to the sentiment of the vulgar, who dream of nothing but of matter) *it is form, which is in truth the whole that we either hear, see, or feel;* nor is *mere matter* any thing better than an *obscure imperfect being*, knowable only to the *reasoning faculty* by the two methods already explained, I mean that of *analogy* and that of *abstraction*. Here therefore we conclude with respect to *sensible forms*, that is to say, *forms inmerged in matter* and *ever inseparable* from it. In *these* and *matter* we place the ELEMENTS OF NATURAL SUBSTANCE."

If this extract appear long, let it be remembered that it contains the fullest and most perspicuous detail which is to be found in the English language, of a doctrine of which the author of *Ancient Metaphysics* supposes Locke to have been ignorant; and for which ignorance he affects to treat the English philosopher with supercilious contempt. Had Locke really been ignorant of the ancient doctrine of *matter* and *form*, it is probable that most people will be of opinion that the *contempt* expressed by his censurer might have been spared; but if it should appear, that, as far as this theory is intelligible, it differs not, except in words, from the doctrine laid down in the *Essay concerning human understanding*, what shall we think of that zeal for ancient phrases, which had influence sufficient to make one respectable philosopher pour contempt upon another who was an ornament to his country?

147 Matter cannot be destitute of solidity.

What Mr Harris has said of *matter* and *form* respecting works of art, is sufficiently intelligible, and extremely just. Nor should we object to the account which he gives of the origin of natural body, if he had not divested his first matter of every power and every quality, solidity and extension not excepted. But though we can suppose body divested of any one particular figure and of every sensible quality, such as colour, odour, tastes, &c. and the *substratum* or *basis* or *matter* of it still to remain, yet it seems impossible to conceive it divested of *solidity* without supposing it totally annihilated. Nay, if we have any just notion at all of solidity, it is evidently inseparable from the substratum of body, whatever that substratum be; and indeed, though Mr Harris divests his first matter of every attribute, the argument by which he proves the necessary existence of such a being does not require its privation to be so universal. "Had the *primary matter* (says he), in its proper nature, any one particular attribute, so as to prevent its privation from being unlimitted and universal, *such attribute would run through all things* and be conspicuous in all." This indeed is obvious and undeniable: but *solidity* and *extension* do in *fact* run through *all things* into which the *substratum* or *matter* of body is ever formed or ever can be conceived to be formed; and therefore there is no necessity for supposing the first matter divested of these attributes (H).

Mr Harris says, that both Timæus and Plato drop ex-

(H) Nor does it appear that it was divested of them by all the ancient philosophers. We learn from Cudworth, that "the atomical physiology, the most ancient perhaps of any, teaches that body is nothing else but διαστατον αντιτυπον, *extended bulk;* and that nothing is to be attributed to it but what is included in the nature and idea of it, viz. greater or less magnitude with divisibility into parts, figure, and position, together with motion or rest, but so as that no part of body can ever move itself. And consequently, this philosophy supposes, that there is no need of any thing else besides the simple elements of magnitude, figure, site, and motion (which are all clearly intelligible, or different modes of extended substance), to solve the corporeal phenomena by; and therefore not of any substantial *forms* distinct from the matter; nor of any other qualities really existing in the bodies without, besides the results or aggregates of those simple elements, and the disposition of the insensible parts of bodies in respect of figure, site, and motion; nor of any intentional *species* or *shews* propagated from the objects to our senses; nor, lastly, of any other kind of motion or action really distinct from local motion (such as generation and alteration), they being neither intelligible as modes of extended substance, nor any way necessary: Forasmuch as the forms and qualities of bodies may well be conceived to be nothing but the result of those simple elements of magnitude, figure, site, and motion, variously compounded together; in the same manner as syllables and words in great variety result from the different combinations and conjunctions of a few letters, or the simple elements of speech; and the corporeal part of sensation, and particularly that of vision, may be solved only by local motion of bodies; that is, either by corporeal effluvia (called *simulacra membranæ* and *exuviæ*), streaming continually from the surface of the objects, or rather, as the later and more refined atomists conceived, by pressure made from the object to the eye, by means of light in the medium. So that ως δια βακτηριας του παθητος αερος το βλεπομενον αναγγελλεται, the sense taking cognizance of the object by the subtile interposed medium, that is tense and stretched (thrusting every way from it upon the optic nerves), doth by that, as it were by a staff, touch it. Again, generation and corruption may be sufficiently explained by concretion and secretion, or local motion, without substantial forms and qualities

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expressions as if they considered *matter* to be *place;* but place, as will be seen afterwards, can be the basis of nothing. He likewise quotes a passage from Ammonius on the predicaments, in which it is said "that there never was in *actuality* either matter without body, or body without quality;" and we appeal to our readers if it be not absolutely impossible to contemplate such a being even in *idea*. To the question, Whether the first matter has a separate existence by itself, distinct from all the qualities of body, the author of *Ancient Metaphysics* answers thus:—"We have no idea of it existing separately, because we find no such thing in nature, from which we draw all our ideas; but whether there may not be such a thing existing in the regions of infinite space, as *matter* without *form* and *dimensions*, is what I think no man can take upon him to decide." But with all submission, if a man cannot decide this question with the utmost certainty, his three ponderous volumes are nothing better than useless paper: for the subject of them is things *existing*; and concerning existence we know nothing with greater certainty than that a being of which nothing positive can be affirmed, cannot possibly have any existence.

148 Some first matter common to all bodies.

That, in the world which we inhabit, bodily substances of every kind, whether natural or artificial, either immediately or mediately pass into one another, is a truth which cannot be denied; and therefore it follows, that there must be some one primary matter common to all things. In modern philosophy this primary matter is considered as solid, and as the *substratum* of all bodies; and all those things which, in the language of Mr Harris, are comprehended under the appellation of *form*, are called *qualities:* so that on this subject the ancient and modern philosophy differ in nothing but in the latter using the word *qualities* instead of the word *form;* and defining the first matter to be a "*solid* substance every where the same," whilst the ancient philosophy considers it as void of solidity.

149 Of the nature of which all men are equally ignorant.

Of the nature of this first matter all philosophers are equally ignorant: for, as Mr Harris says, it is in truth *form;* or, as modern philosophers would say, they are in truth *qualities*, which are the whole that we either hear, or see, or feel, or of which we have either idea or conception. Mr Locke says expressly, "That if any one will examine himself concerning his notion of pure substance in general, he will find that he has no other idea of it at all, but only a supposition of he knows not what support of such qualities as are capable of producing simple ideas in us."

150 How we know that the things immediately perceived are qualities.

But how, it has been asked, do we know that the things which we perceive are qualities, and cannot exist without a subject? We answer, Because every one of them, except solidity, may be changed or destroyed, and the subject in which they inhere still remain. Thus, though wax may be melted or burnt, and be no longer a hard red substance of such a figure and such a smell, the matter which supported the hardness, figure, colour, and smell still remains; for melted wax or ashes is as much a solid substance as is that which may be used for the sealing of letters, &c.

It has been said that solidity (1) is the *substratum* of

lities. And lastly, those sensible ideas of light and colours, heat and cold, sweet and bitter, as they are distinct things from the figure, site, and motion of the insensible parts of bodies, seem plainly to be nothing else but our own fancies, passions, and sensations, however they be vulgarly mistaken for qualities in the bodies without us." *Cudworth's Intellectual System*, Book i. chap. 1.

This, as will be seen by and by, is the philosophy of Newton, Locke, and all their followers: and that it is the genuine philosophy of the ancient atomists, we may safely take the word of the author whom we have quoted; for no modern has been more conversant with their writings, more completely master of their language, or has given their sense with greater accuracy. Those authors, therefore, who in their zeal for ancient metaphysics would explode the physiology of Newton and Locke, and substitute in its place the Aristotelian doctrine of *matter* and *form*, belie their own pretences; for the theory which they would banish is more ancient than that which they wish to introduce; and we appeal to our readers if it be not more intelligible.

(1) The philosophers of most eminence who have maintained this opinion are, *Dr Watts*; the author of the *Procedure, Extent, and Limits, of the Human Understanding*; and *Dr Law* late bishop of Carlisle, who in a note upon *King's origin of evil* gives the opinion of the triumvirate in the following words:—"We find by experience, that a thing will always exhibit the same appearances in some respects, though it admit of changes in others: or, in Mr Locke's language, that certain numbers of simple ideas go constantly together, whereas some others do not. The former of these we call the *substance*, thing, or being, itself; the latter are termed its modes or *accidents*. Thus the substance of *body*, as far as we know of it, consists in solidity and extension; which being necessarily finite, it also becomes capable of division, figure, and motion. These are its original inseparable qualities, which constitute the thing, and seem not to depend on any thing else as a *subject*. But a particular figure, motion, &c. are only accidents or modes of its existence; which do not necessarily attend it, though they themselves cannot be supposed to exist without it. The substance of *spirit* consists in the powers of thinking and acting, which likewise admit of various modifications. This seems to be all that we can learn concerning the nature of things from observation and experience. To inquire into the *manner* how these, which we call *properties*, exist together, or to attempt to explain the *cause*, ground, or reason, of their union, is in vain. To assign the word *substance* for a representation of it, is saying nothing: it is setting a mere word for what we have neither any idea of nor occasion for. Indeed if we consider these primary qualities as needing something to inhere in, we are obliged to seek for something to support them: and by the same way of reasoning, we may seek for something else to support that other something, and so on; and at last shall find no other support for the whole but the cause which produced it." "Dr Watts (continues the bishop) is of opinion, that it is introducing a needless *scholastic* notion into the real nature of things, and then fancying it to have a real existence;" (*Logic*, p. 14.) The author of the *Procedure, Extent*, &c. affirms, "That as far as we directly know the essential properties of any substance, so far as we have a *direct* knowledge of the substance

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of body; and men have been probably led into this notion from a conviction that such *substratum*, whatever it be, is and must be solid; but that solidity is only a quality inseparable from the first matter, and not that matter itself, must be evident from this consideration, that solidity is the same in all bodies, and incapable of producing by itself any other effect than that of excluding from the place occupied by it every other solid substance. It could not of itself be the *substratum* of colour, taste, or smell, otherwise all bodies would be coloured, sapid, and odorous; and as, according to all our notions of it, it is incapable of any change, it could not by itself be so modified as to excite in us these sensations.

151 Our notion of matter relative and obscure

The things then immediately perceived by us, or of which we have any adequate idea or conception, are only qualities which must belong to a subject; and all that we know about this subject is, that it is that to which such qualities belong. From this it is evident, that our notion of matter, as distinguished from its qualities, is a relative § and obscure notion, and must remain obscure till men have other faculties. In this the philosopher seems to have no advantage above the vulgar: for as they perceive colour, and figure, and motion, by their senses, as well as he does; and as both are equally certain that there is a subject of those qualities; so the notions which both have of this subject are equally obscure; or, to speak more properly, they have no *positive* notion of it all. When a philosopher calls it the *first matter*, a *substratum* or a *subject* of *inhesion*, those learned words convey no meaning but what every man understands and expresses, by saying in common language, that it is a thing extended, solid, and moveable.

§ Reid's Essays on the Intellectual Powers of Man.

They are therefore *qualities*, or in the language of ancient philosophy, *forms* alone, about which, in corporeal substance, we can reason with precision and certainty; and it is sufficient for all the purposes of life that we have of them an adequate knowledge. For as the *first matter* or original *substratum* of all bodies seems to be the same, though we know not what it is; and as one body is distinguished from another only by its *qualities* or *powers*; a knowledge of the nature of these is all that can be necessary to direct our conduct with respect to the various objects with which we are surrounded.

152 Qualities primary and

Qualities thus considered in bodies, are, first, such as are utterly inseparable from the body, in what state soever it is; such as in all the changes and alterations which it suffers, and under all the force which can be employed upon it, it constantly keeps. Thus, in the instance already given, a stick of sealing-wax may, by the operation of fire, be rendered liquid or reduced to smoke and ashes; and when it has undergone these changes, it has lost many of the sensible qualities which it had when a long round substance fit for the purpose of sealing letters; but other qualities which were then perceivable in it still remain: for not only liquid wax, but every particle of smoke and ashes, is solid and extended, as well as the hardest or largest body; and every such particle has likewise some figure, and is capable of motion or rest. Again, if a grain of wheat or any other corporeal substance be divided into two parts, and each part be again divided without end, still the smallest particle of it will be solid, extended, of some figure, and capable of further division. *Solidity*, *extension*, *divisibility*, and *motion* or *rest*, are therefore qualities inseparable from *body*, and have on that account been with great propriety called its *original* or *primary qualities*.

153 Secondary.

There are other qualities, which in truth are nothing in the bodies themselves, but powers arising from the magnitude, figure, texture, and motion, of their insensible parts, to produce in us various sensations; such are *colours*, *sounds*, *tastes*, and *odours*. These have been denominated *secondary qualities*; and to them may be added a third sort, which are universally allowed to be barely *powers*, though they are in fact as much real qualities in the subject as those we have just mentioned. Thus the power in fire to produce by its primary qualities a new colour or consistency in wax or clay, is as much a quality in the fire as the power which it has to produce in us a new sensation of warmth or burning. That *colours*, *tastes*, *sounds*, and *odours*, as they are perceived by us are mere sensations, has been already proved: and that the powers in the bodies which produce these sensations are not, like *solidity* and *extension*, inseparable from the body to which they may belong, is evident; because a piece of *red* wax may be reduced to *black* ashes; and because by pounding an almond we may change its clear white colour into a dirty hue, and its pleasant taste into one that is oily and rancid; and a single rent through the body of a bell destroys its sound.

The primary qualities of body have a real existence, independent of us and of every other creature. Thus the particular *bulk*, *number*, *figure*, and *motion*, of the *parts* of *fire* or *snow* are *really in the fire or snow*, whether any man's senses perceive them or not; and therefore these may be called *real qualities*, because they really exist in the bodies: but *light*, *heat*, *whiteness*, or *cold*, (as they are perceived by us), are no more *really in fire or snow*, than sickness is in *tartar* or pain in a *sword*. Take away the sensations of them: let not the eyes see light or colours, nor the ears hear sounds; let not the palate taste nor the nose smell; and all colours, tastes, odours, and sounds, as they are such particular sensations, vanish and cease, and are reduced to their causes, *i. e.* to the bulk, figure, and motion of the parts of the body.

154 Bodily qualities are of three sorts.

The qualities then that are in bodies, rightly considered, are of three sorts. 1. The *bulk*, *figure*, *number*, *situation*,

substance *itself*: and if we had a direct knowledge of *all* the essential properties of any substance, we should have an *adequate* knowledge of that substance; for surely, if there be any meaning in words, the knowing any thing of the essential properties of a thing is knowing *so much* of its very substance."

That the substance of body consists in *solidity* and *extension*, and nothing more; and that these depend not upon any thing else as a *subject*; cannot be true: for *solidity*, in our conception, is nothing but *impenetrability*; but whoever uses the word *impenetrability*, certainly means that there is *something* impenetrable. That there is some real thing or being different from solidity and extension, which impresses us with the notion that it is solid and extended, is self-evident to all mankind; if it be not matter, these conceptions must be communicated

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situation, and *motion* or *rest*, of their *solid* parts. Of these, as they are in themselves, we have clear and distinct notions. We know that they are in the body whether we perceive them or not, and we call them *primary* or *essential qualities*. 2. The power that is in any body, by reason of its internal texture and insensible primary qualities, to operate upon our senses in a peculiar manner, producing in us the different sensations of *colours*, *sounds*, *tastes*, or *smells*, &c. These we have called *secondary qualities*, but they are often termed *sensible qualities*. 3. The *power* that is in any body, by reason of the particular constitution of its primary qualities, to make such a *change* in the *bulk*, *figure*, *texture*, and *motion* of *another body*, as to make it operate on our senses differently from what it did before. Thus, the sun has a power to make wax white, and fire to make lead fluid. These are universally called *powers*; but we have no such notions of them as we have of the *primary qualities* of bodies. We know that they exist, but we know not what they are. It has indeed been discovered, that the sensation of smell is occasioned by the effluvia of bodies†; that of sound, by their vibration. The disposition of bodies to reflect a particular kind of light occasions the sensation of colour; and the operation of the minute parts of bodies upon the nerves of the tongue and palate is the cause of tastes. Very curious discoveries have been made of the nature of heat and its manner of operating, and an ample field still remains. We are likewise intuitively certain, that body can operate upon body only by impulse; but how certain impulses upon certain organs should produce sensations in us to which there is nothing similar in the impelling body, is equally unknown to the clown and the philosopher.

† Reid's Essays on the Intellectual powers of Man, and Locke's Essay, &c.

155 The doctrine of the ancient atomists respecting qualities.

Such is the distinction which in modern philosophy is made between primary and secondary qualities; but it is a distinction which was likewise well known to that sect of ancient philosophers who were denominated *atomists*. At the head of these were Thales and Pythagoras (K); and we may infer from Aristotle, that the sect comprehended almost all the physiologists who taught before himself and Plato: for he says*, Δημοκριτος και οι πλειστοι των φυσιολογων ατοπωτατον τι ποιουσι, παντα γαρ τα αισθητα απτα ποιουσι, και εις σχηματα αναγουσι τους χυμους: "Democritus, and *most* of the *physiologists*, fall into a great absurdity; for they make all sense to be touch, and resolve sensible qualities into the figures of insensible atoms." And he adds, that "the former physiologists (without exception) said not well, that there is no black and white without the sight, nor bitter and sweet without the taste." He elsewhere § tells us, that those philosophers explained generation and alteration without forms and qualities, by figures and local motion." Δημοκριτος και Λευκιππος ποιησαντες τα σχηματα την αλλοιωσιν και την γενεσιν εκ τουτων ποιουσι, διακρισει μεν και συγκρισει γενεσιν και φθοραν, ταξει δε και θεσει αλλοιωσιν. "Democritus and Leucippus having made figures (or variously figured atoms) the first principles, make generation and alteration out of these; namely, generation together with corruption from the concretion and secretion of them, but alteration from the change of their order and position." By the atomic physiologists the name of *quality* was generally applied only to those things which we have called *secondary qualities*. The *primary* being considered as *essential* to *matter*, were seldom, if ever, called *qualities*. That the atoms, which they held to be the first principles of bodies, were figured, solid, extended, and moveable, is apparent, not only from the short view of their system which we have given from Cudworth, but likewise from the passages which we have just quoted from Aristotle: but the question debated between them and their antagonists was, whether those atoms had *smell*, *taste*, and *colour*; or, as it was commonly expressed, whether they had *qualities*? Democritus, Leucippus, and the other atomists, we see, maintained that they had not; and the following account of the doctrine of Protagoras, another philosopher of that school, shows, that on this subject at least the ancient advocates for the atomic system reasoned as justly as any of the moderns, and much more justly than the Peripatetics and Platonists by whom they were opposed. Plato having in his Theætetus first said in general that the philosophy of Protagoras made all things to consist of a commixture of atoms and local motion, represents his doctrine concerning colours in particular, after this manner: "First, as to that which belongs to the sight, you must conceive what is called a white or black colour, not to be any thing absolutely existing either without your eyes or within your eyes; but black and white, and every other colour, is caused by different motions made upon the eye, from objects differently modified; so that it is nothing either in the agent or patient absolutely,

* Lib. de Sensu et Sensibili, cap. 4.

§ De Generatione et Corruptione, lib. i. cap. 2.

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cated to us by the immediate agency of the Deity, which seems to have been the real opinion of the Bishop of Carlisle. But this differs not from the theory of Berkeley, which we shall consider by and by.

(K) This is denied by Bishop Warburton, who thinks nothing better settled than that Democritus and Leucippus were the authors of the atomic physiology. We highly respect the learning and ingenuity displayed in the Divine Legation of Moses; but on this point we are convinced that its author is mistaken. Strabo expressly affirms, that Mochus the Phenician was the author of the atomic physiology; and Cudworth has proved, by arguments which to us are perfectly satisfactory, that Thales and Pythagoras were both atomists, and that they derived the doctrine from Phœnicia or Egypt. They did not, indeed, speculate in physics, but delivered their doctrines as they had received them from tradition, and they referred all motion to mind as its cause. Leucippus and Democritus, we believe, were the first speculative atomists: but though they refined upon, and perhaps improved, the mere mechanical part of the physiology of their masters, they unhappily dropt the better part of it; and, banishing mind from their system of the universe, they became materialists and atheists. With the sober and pious part of philosophers this brought the atomic theory into disrepute; and Plato and Aristotle, who were theists, when they opposed that theory, always pointed their arguments against Leucippus and Democritus, which is probably what led the learned bishop to consider these atheists as the authors of the atomic physiology.

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solutely, but something which arises from between them both (L)." From this passage it is plain that Protagoras thought of colours exactly as Mr Locke thought, that they are not *real qualities* existing in bodies, but merely sensations excited in our minds; and indeed he is presently after represented as having called them τινα εν ημιν φασματα, *certain fancies* or *appearances in us*. But there is in the Theætetus another passage, in which a fuller account is given of the atomic philosophy, to this purpose: "The principle upon which all these things depend is this, That the whole universe (M) is motion of atoms and nothing else; which motion is considered two ways, and is accordingly called by two names *action* and *passion*. From the mutual congress, and, as it were, attrition of these together, are begotten innumerable offsprings, which, though infinite in number, yet may be reduced to two general heads, *sensibles* and *sensations*, which are both generated at the same time. The *sensations* are *seeing*, *hearing*, and the like; and the corresponding *sensibles* are *colours*, *sounds*, &c. Wherefore, when the eye and its proper object meet together, both the αισθητον and the αισθησις, the *sensible idea* of white and black, and the *sensation* of seeing, are generated together, neither of which would have been produced if those two had not met. The like is to be conceived of all other *sensibles*, as hot and cold, &c. None of these are absolute things in themselves, or real qualities in external objects; but they are begotten from the mutual congress of agent and patient, and that by motion. So that neither the agent has any such thing in it before its congress with the patient, nor the patient before its congress with the agent. But the agent and patient meeting together, and begetting *sensation* and *sensibles*, both the object and the sentient are forthwith made to be so and so qualified; as when honey is tasted, the sensation of tasting, and the quality of sweetness, are begotten together, though the sensation be vulgarly attributed to the taster, and the quality of sweetness to the honey." The conclusion of all which is summed up thus, ουδ' εν ειναι αυτο καθ αυτο, αλλα τινα αει γιγνεσθαι: "Not one of these sensible things is any thing absolutely in the object without, but they are all generated or made relative to the sentient (N)."

The language of ancient philosophy was defective in precision; terms were used vaguely and improperly, so that the meaning of the author is often to be collected only from the context. When Protagoras is here made to say, that when the agent and patient meet together, both the object and the sentient are forthwith made to be so and so *qualified*; as when honey is tasted, the sensation of tasting and the *quality* of sweetness are begotten together; it could not be his meaning, that any real change is made upon the external object merely by our tasting it, but only that the actual sensation and the sensible *idea* of sweetness are produced at once; just as he had said before, that the sensible idea of white or black, and the sensation of seeing, are generated together. If his words be thus interpreted, they express a noble truth; and the whole passage shows, that the ancient Atomic theory differed not from the theory of Des Cartes, Newton, and Locke, being the most rational as well as the earliest system of physics with which we have any acquaintance. By divesting body of *essential forms* distinct from matter and motion, and by giving to the first matter extension and solidity, it renders the corporeal world intelligible; and accounts for those appearances which are called secondary qualities, in a manner perfectly satisfactory. Aristotle indeed opposed the Atomic philosophy, and had influence enough to bring it into disrepute for many ages; but when he insisted that the two constituent principles of body are *matter* and *form*, both independent of all sentient beings, and which may be conceived as existing distinct from each other, he substituted for a simple and sublime theory an absurd and incomprehensible fiction.

Of the Essences of Bodies.

Chap. II. *Of the* Essences *of* Bodies.

156 The essences of bodies resule.

Having treated of the substance, qualities, and powers of body, we may seem to have exhausted this part of our subject; but there is still more to be done. Metaphysicians, ancient and modern, have introduced another term into the science, to denote that which distinguishes one species or sort of bodies from all other species or sorts; and this term we shall briefly explain. Gold is apparently different from lead, and from every other species of metal; a horse is apparently different from an ox, and from every other species of animals; and all animals apparently differ from all vegetables, as vegetables differ from metals.

157 According to the Peripatetics and Platonists, from essential forms;

It is only with the *bodies*, not the minds of animals, that we are at present concerned; and we have seen that all bodies are composed of the same matter.—What then is it that makes different bodies exhibit to us such different appearances; or, in other words, how come they to be possessed of such different qualities and powers? It is (say the followers of Plato and Aristotle) from their having different *essential forms*, by which every natural substance is essentially characterised; for every animal, vegetable, or metal, &c. there is a *form* conceived as existing before the individuals in which it is incorporated, from which result all the properties of that animal, vegetable, or metal, such as *figure*, *size*, *colour*, and the other qualities.

(L) Υπολαβε τοινυν ουτωσι κατα τα ομματα πρωτον, ὁ δε καλεις χρωμα λευκον μη ειναι αυτο ετερον τι εξω των των ομματων, μηδ' εν τοις ομμασι, αλλα μελαν τε και λευκον και ὁτιουν αλλο χρωμα εκ της προσβολης των ομματων προς την προσηκουσαν φοραν φανεται γεγενημενον και ο δε εκαστον ειναι φαμεν χρωμα, ουτε το προσβαλλον ουτε το προσβαλλομενον αλλα μεταξυ τι εκαστω ιδιον γεγονος.

(M) Protagoras was a follower of Leucippus and Democritus in every thing, and of course an atheist.—This, however, does not hinder him from having been a correct physiologist with respect to the composition of body; and as such only is he quoted by us. It is, indeed, melancholy to think, that there was hardly a sect of ancient philosophers in which there were not many atheists.

(N) Αρχη δε εξ, ὑς α νυν δη ελεγομεν παντα ηρτηται ἡ δε αυτων, ὡς το παν κινησις ην και αλλο παρα τουτο ουδεν, της δε κινησεως δυο ειδη, πληθει μεν απειρον ἑκατερον, δυναμιν δε το μεν ποιειν εχον, το δε πασχειν, &c.——See the *Theætetus*; see also *Cudworth's Intellectual System*, Book I. chap. i.

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ties perceptible by our senses: but this *internal and essential form* itself, from which all other forms result, is not perceptible by our senses, nor even by our understanding directly and immediately, nor otherwise than by the analogy formerly mentioned. These essential forms, we are told, mean something, which, though different from matter, can yet never subsist without it; something which, united with it, helps to produce every *composite* being, that is to say, in other words, every natural substance in the visible world.

158 But these forms have no existence.

This assertion Mr Harris submits with deference to his contemporaries; because (says he) "I speak perhaps of spectres as shocking to some philosophers as those were to Æneas which he met in his way to hell—*Terribiles visu formæ.*" The elegant author's unwillingness to frighten his contemporaries, was a proof of his amiable and benevolent disposition; but he needed not to have suffered from any such apprehension. Those spectres, apparently so dreadful, had long before been laid to rest by the incomparable Cudworth, who has demonstrated, that *essential forms* different from matter and motion, as they have no real existence, had no place in the most ancient philosophy; and that the different appearances or sensible qualities which different bodies exhibit, are the result of the different contexture of their insensible parts. Thus, gold and lead are composed of the same primary matter, but the atoms or minute parts of that matter are in the one substance differently combined from what they are in the other; and this different combination is the sole cause that gold is specifically heavier than lead, more ductile, and of a different colour, &c. For the very same reason, iron is harder than either gold or lead, specifically lighter, and possessed of many other sensible qualities which are not found in either of these substances. One vegetable differs from another externally in size, colour, taste, smell, rapidity of growth, and proportion of parts, &c. but all vegetables are composed of the same matter; and the external difference which prevails among them is the result of a different structure and motion of their insensible parts. The same is to be said of the differences which prevail among the bodies of animals; they all result from internal organization and motion, and from nothing else, whatever be the immediate cause of that motion.

159 The real essences of bodies unknown to us.

This particular internal texture and motion of insensible parts, is that which makes one sort of bodies differ externally from every other sort of bodies; and it is by modern metaphysicians called the *real essence* of bodies. Thus, that internal texture of minute parts, which makes gold of a bright yellow, extremely ductile, specifically heavier than all other metals, and soluble in *aqua regia*, is the real essence of gold; but what that essence is in itself no man can tell, as we perceive only the qualities which result from it. We are, however, certain, that it is different from the real essences of lead and iron, because it produces different effects from those which are produced by these essences; and different effects are never produced in the same circumstances by the same cause.

We have called the internal texture and motion of the insensible parts of bodies their *real essences*, to distinguish them from other *essences* which are only *nominal*, and with which we are perfectly acquainted, because they are the fabrication of our own minds.—Thus, a beautiful bright yellow, a certain specific gravity, extreme ductility, and solubility in *aqua regia*, are the qualities by which we distinguish gold from all other metals. Of these qualities we frame a sort of general conception, which we call the *essence* of gold; and every substance in which we find this essence, we class under the specific name gold. For though it is obvious that our conceptions cannot be the *real essences* of things external, yet are they sufficient guides to these essences, as we know that bodies which, being all formed of the same matter, have the very same sensible qualities, must likewise have the same internal organization or texture of parts, because it is only in that organization or texture that one body can differ from another.—And so much for bodily substance, qualities, and essences.

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160 Nominal essences, what they are.

Chap. III. *Of the* Existence *of* Matter.

161 Berkeley attempts to demonstrate that matter has no existence.

We have endeavoured to prove, that all corporeal substances consist of minute atoms, solid and extended; and that the sensible qualities of every body result from the combination and motion of the atoms of which that body is composed. The celebrated Berkeley, Bishop of Cloyne, however, attempted to demonstrate that these atoms have no real existence; and that the very supposition of a solid, extended, and inert substance, being the archetype of our ideas, involves in it an absurdity and contradiction.

It is universally allowed, that all our knowledge of matter is derived through the senses, either immediately in the very act of sensation, or mediately by an association which is resolvable into a process of reasoning. According to the principles which we have stated, and laboured to establish, matter itself is no immediate object of the senses; and as these are the principles upon which the Bishop erected his demonstration, it will be incumbent upon us to consider his theory, because it has been represented as in the highest degree pernicious, and as leading to universal scepticism.

162 The view of his theory given by his antagonists.

The author of the *Essay on the Nature and Immutability of Truth*, represents Berkeley as teaching us, "that external objects (that is, the things which we take for external objects) are nothing but ideas in *our* minds; in other words, that they are in every *respect* different from what they appear to be; that matter exists not but in *our* minds; and that independent on *us* and *our* faculties, the earth, the sun, and the starry heavens, have no existence at all; that a lighted candle hath not *one* of *those qualities* which it *appears to have*; that it is not white, nor luminous, nor round, nor divisible, nor extended; but that, for any thing we know, or can ever know to the contrary, it may be an Egyptian pyramid, the king of Prussia, a mad dog, the island of Madagascar, Saturn's ring, one of the Pleiades, or nothing at all." With respect to the consequences of this theory, he affirms, that "it is subversive of man's most important interests, as a moral, intelligent, and percipient being; and not only so, but also, that if it were universally and seriously adopted,

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ed, the diſſolution of ſociety, and the deſtruction of mankind, would neceſſarily enſue within the compaſs of a month.

The diſſolution of ſociety and the deſtruction of mankind are indeed diſmal conſequences—enough to make a man ſhudder in his cloſet. But do they really flow from Berkeley's ſyſtem? They certainly do, if it be the aim of that ſyſtem to prove that a candle has not any one quality which it appears to have, and that it may be a *mad dog*; for ſhould all philoſophers, by ſome means or other, become converts to the theory of Berkeley, as we know that the biſhops Sherlock, Smalridge, and others actually did, the diſſolution of ſociety and the deſtruction of mankind would indeed be inevitable. The ſcribbling race, by uſing mad dogs for candles, would all become infected with the hydrophobia; and having their natural irritability augmented by the canine rabies, they would bite and tear till not a human being were left alive.

163 A view of his theory given by himſelf.

But to drop this ludicrous ſtyle, ſo unſuitable to philoſophical inveſtigation and calm enquiry, we beg leave to affirm, that the theory of Berkeley is here totally and groſsly miſrepreſented, and that not one of thoſe dangerous conſequences which flow from that miſrepreſentation can be fairly deduced from any thing taught in *The Principles of Human Knowledge* and the *Dialogues on the Exiſtence of Matter*. So far is Berkeley from teaching that external things are nothing but ideas in *our* minds, and that they are in every reſpect different from what they appear to be, that he teaches the very reverſe of this in the plaineſt language poſſible. "I am of a vulgar caſt (ſays he), ſimple enough to believe my ſenſes, and leave things as I find them. It is my opinion, that the real things are thoſe very things I ſee and feel and perceive by my ſenſes. That a thing ſhould really be perceived by my ſenſes, and at the ſame time not really exiſt, is to me a plain contradiction. When I deny ſenſible things an exiſtence out of the mind, I do not mean *my* mind in particular, but *all* minds. Now it is plain they have an exiſtence exterior to my mind, ſince I find them by experience to be independent of it. There is therefore ſome other mind wherein they exiſt during the intervals between the times of my perceiving them; as likewiſe they did before my birth, and would do after my annihilation. And as the ſame is true with regard to all other finite created ſpirits, it neceſſarily follows there is an *omnipotent eternal mind*, which knows and comprehends all things, and exhibits them to our view in ſuch a manner, and according to ſuch rules, as he himſelf hath ordained, and are by us termed the laws of nature."

So far is Berkeley from teaching that, independent on *us* and *our* faculties, the earth, the ſun, and the ſtarry heavens, have no exiſtence at all, and that a lighted candle has not one of thoſe qualities which it appears to have, that he over and over affirms the direct contrary; that the univerſe has a real exiſtence in the mind of that infinite God in whom, according to the ſcriptures, we all live, and move, and have our being; that a lighted candle has not only all thoſe qualities which it appears to have, but that, with reſpect to us, it has nothing elſe; that ſo far from being continually deceived by our ſenſes, we are never deceived by them; and that all our miſtakes concerning matter are the reſult of falſe inferences from true ſenſations.

The Biſhop makes the ſame diſtinction that we have made between ideas and notions; reſtraining the uſe of the former term to denote the relicts of ſenſations, and employing the latter to denote our knowledge or conception of ſpirits and all ſuch objects as are not perceived by ſenſe. He likewiſe affirms, that we can have no *idea* of an external inert ſubſtance; becauſe an idea can be like nothing but another idea, or the ſenſation of which it is a relict: and as all mankind admit that ideas and ſenſations can have no exiſtence but in the mind of a percipient being, he therefore infers that we can have no *idea* of any thing exiſting unperceived, and by conſequence can have no idea of matter in the philoſophical ſenſe of that word. Solidity, extenſion, diviſibility, motion, figure, colour, taſte, and all thoſe things which are uſually called qualities primary and ſecondary, being according to him mere ideas, can have no exiſtence but in a mind perceiving them; but ſo far is he from ſuppoſing their exiſtence to depend upon the perception of our minds, that he ſays expreſsly, "When in broad day-light I open my eyes, it is not in my power to chooſe whether I ſhall ſee or no, or to determine what particular objects ſhall preſent themſelves to my view; and ſo likewiſe as to the hearing and other ſenſes, the ideas imprinted on them are not creatures of my will. There is therefore, ſome other will or ſpirit that produces them. The queſtion between the materialiſts and me is not, Whether things have a real exiſtence out of the mind of *this* or *that* perſon? but, Whether they have an abſolute exiſtence, diſtinct from being perceived by *God*, and exterior to *all minds*? I aſſert, as well as they, that ſince we are affected from without, we muſt allow powers to be without in a being diſtinct from ourſelves. So far we are agreed. But then we differ as to the kind of this powerful being. I will have it to be ſpirit; they matter, or I know not what third nature. Thus I prove it to be ſpirit: From the effects I ſee produced, I conclude there are actions; and becauſe actions, volitions (for I have no notion of any action diſtinct from volition); and becauſe there are volitions, there muſt be a will. Again, the things I perceive muſt have an exiſtence, they or their archetypes, out of my mind: but being ideas, neither they nor their acrchetypes can exiſt otherwiſe than in an underſtanding: there is therefore an underſtanding. But will and underſtanding conſtitute in the ſtricteſt ſenſe a mind or ſpirit. The powerful cauſe, therefore, of my ideas is, in ſtrict propriety of ſpeech, a ſpirit."

164 That theory, however improbable, certainly poſſible, and

This is a faithful abſtract of Berkeley's theory given in his own words. Matter, according to him, cannot be the *pattern* or *archetype* of ideas, becauſe an idea can reſemble nothing but another idea, or the ſenſation of which it is a relict. Matter, he thinks, cannot be the *cauſe* of ideas; for every cauſe muſt be active, and matter is defined to be inert and incapable of action. He therefore infers, that all our ſenſations of what we call the qualities of body are the effect of the immediate agency of the Deity upon our minds; and that corporeal ſubſtance has no exiſtence, or at leaſt that we have no evidence of its exiſtence. That ſuch may *poſſibly* be the origin of our ſenſations, no man

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man will deny who reflects upon the infinite power and wisdom of the Agent from whom they are said to proceed. Dr Reid himself, the ablest of all Dr Berkeley's opponents, frankly acknowledges that no man "can show, by any good argument, that all our sensations might not have been as they are, though no body or quality of body had ever existed."

165 In its consequences harmless.

In its consequences we do not perceive that this theory can be hurtful either to religion, to virtue, or to the business of common life; for it only explodes the notion of a substratum, which, though it may have a real existence, was never thought of by the generality of mankind in any nation under heaven. Dr Beattie indeed affirms, that in "less than a month after the nonexistence of matter should be universally admitted, he is certain there could not, without a miracle, be one human creature alive on the face of the earth." But this assertion must be the consequence of his mistaking Berkeley's nonexistence of matter for the nonexistence of sensible objects, the reality and existence of which the Bishop never denied. On the contrary, he expressly says, "We are sure that we really see, hear, feel; in a word, that we are affected with sensible impressions; and how are we concerned any farther? I *see* this cherry, I *feel* it, I *taste* it; and I am sure *nothing* cannot be seen, or felt, or tasted: it is therefore *real*. Take away the sensations of softness, moisture, redness, tartness, and you take away the cherry." All this is equally true and equally conceivable, whether the combined sensations which indicate to us the existence of the cherry be the effect of the immediate agency of God or of the impulse of matter upon our minds; and to the lives of men there is no greater danger in adopting the former than the latter opinion.

166 A consequence of Berkeley's theory; which

But it has been said, that Berkeley's doctrine necessarily leads to scepticism in religion, as the same kind of reasoning which he employs to prove the non-existence of matter, operates equally against the existence of mind, and consequently against the possibility of a future state of rewards and punishments. "The rational issue of this system (we are told) is scepticism with regard to every thing excepting the existence of our ideas and their necessary relations. For ideas being the only object of thought, and having no existence but when we are conscious of them, it necessarily follows that there is no object of our thought which can have a continued and permanent existence. Body and spirit, cause and effect, time and space, to which we were wont to ascribe an existence independent of our thought, all are turned out of existence by this short dilemma: Either those things are ideas of sensation or reflection, or they are not: If they are ideas of sensation or reflection, they can have no existence, but when we are conscious of them: If they are not ideas of sensation or reflection, they are words without any meaning."

This sophism was advanced as a consequence from Berkeley's principles by Mr Hume; and upon these principles it has been deemed unanswerable by subsequent philosophers of great merit. But is it really a part of Berkeley's system, or can it be fairly inferred from the principles on which that system is built? These questions it is fit that Berkeley should answer for himself: and we shall venture to assert, that his answer will be perfectly satisfactory to every reader who attends to the distinction, which, after the Bishop, we have stated between ideas and notions.

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167 That author foresaw and

Though we believe this dangerous inference from Berkeley's principles is commonly attributed to Hume as its author, it did not escape the sagacity of the Bishop himself. In the third dialogue, *Hylas*, who pleads for the existence of matter, thus objects to the reasoning of his antagonist. "Notwithstanding all you have said, to me it seems, that according to your own way of thinking, and in consequence of your own principles, it should follow, that you are only a system of floating ideas, without any substance to support them. Words are not to be used without a meaning. And as there is no more meaning in spiritual substance than in material substance, the one is to be exploded as well as the other."

168 Obviated; but

To this *Philonous* answers: "How often must I repeat, that I know or am *conscious* of my own being; and that I myself am not my ideas, but somewhat else; a thinking active principle, that perceives, knows, wills and operates about ideas? I know that I, one and the same self, perceive both colours and sounds; that a colour cannot perceive a sound, nor a sound a colour; that I am therefore one independent principle, distinct from colour and sound; and, for the same reason, from all other sensible things and inert ideas. But I am not in like manner *conscious* either of the existence or essence of matter. Farther, I know what I mean, when I affirm that there is a spiritual substance or support of ideas; *i. e.* that a spirit knows and perceives ideas. But I do not know what is meant, when it is said that an unperceiving substance hath inherent in it, and supports, either ideas or the archetypes of ideas. In the very notion or definition of material substance there is included a manifest repugnace and inconsistency. But this cannot be said of the notion of spirit. That ideas should exist in what doth not perceive, or be produced by what doth not act, is repugnant. But it is no repugnancy to say, that a perceiving thing should be the subject of ideas, or an active being the cause of them. That I, who am a spirit or thinking substance, exist, I know as certainly as I know that my ideas exist. I know likewise what I mean by the terms *I* and *myself*; and I know this immediately or intuitively; though I do not perceive it as I perceive a triangle, a colour, or a sound. Ideas are things inactive and perceived; and spirits a sort of beings altogether different from them, by which they are perceived. I do not, therefore, say, that my soul is an idea, or like an idea, However, taking the word *idea* in a large sense, my soul may be said to furnish me with an idea, that is, an image or likeness of God, though indeed extremely inadequate. For all the notion I have of God is obtained by reflecting on my own soul, heightening its powers, and removing its imperfections. I have, therefore, though not an inactive idea, yet in myself some sort of an active thinking image of the Deity. And though I perceive him not by sense, yet I have a notion of him, or know him, by reflection and reasoning. My own mind and my own ideas I have an immediate knowledge of; and by the help of these do immediately apprehend the *possibility* of the existence of other spirits and ideas. Farther, from

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from my being, and from the dependency I find in myself and my ideas, I do by an act of reason *necessarily* infer the existence of a God, and of all created things in the mind of God. It is granted that we have neither an immediate evidence, nor a demonstrative knowledge, of the existence of *other finite spirits*; but it will not therefore follow, that such spirits are on a footing with material substances: if, to suppose the one be inconsistent, and if it be not inconsistent to suppose the other; if the one can be inferred by no argument, and there is a probability of the other; if we see signs and effects indicating distinct finite agents like ourselves, and see no sign or symptom whatever that leads to a rational belief of matter. I say, lastly, that I have a *notion* of spirit, though I have not, strictly speaking, an *idea* of it. I do not perceive it as an idea, or by means of an idea; but know it by reflection. Whereas, I neither perceive matter objectively as I do an idea, nor know it as I do myself by a reflex act; neither do I mediately apprehend it by similitude of the one or the other, nor yet collect it by reasoning from that which I know immediately. All which makes the case of matter widely different from that of the Deity and all spirits."

169 Not satisfied with this, he endeavours to prove the existence of matter impossible.

Thus far we think Berkeley's theory tenible, and its consequences harmless. That by the immediate agency of the Deity all our sensations *might* be what they are, though matter had no existence, we think he has proved by arguments unanswerable; and we are likewise of opinion, that by admitting the evidence of sense, consciousness, and reason, in their fullest extent, and by distinguishing properly between those things of which we have *ideas*, and those of which we have *notions*, he has sufficiently secured the existence of spirits or percipient beings, and obviated the irreligious sophistry of Hume before it was conceived by that author. But the good Bishop stops not here. Not satisfied with proving that all our sensations lead us immediately to the Deity, and that, for aught we know, matter, as defined by philosophers, may have no separate existence, he proceeds farther, and endeavours to prove that matter cannot possibly exist. This appears even in the extracts which we have quoted from his book, in which he talks of the repugnance and inconsistency of the notion. In this part of his system, we think he errs greatly, and advances an opinion altogether inconsistent with his own just principles.

170 His reasoning

The repugnance of which he speaks, arises solely from considering solidity and extension as relicts of sensation, or ideas of the same kind with those of heat and cold, tastes and sounds. "Light, and colours, heat and cold, extension and figures; in a word, the things we see and feel; what are they (says his Lordship), but so many sensations, notions, ideas, or impressions, on sense? and is it possible to separate even in thought any of these from perception? Some there are who make a distinction betwixt *primary* and *secondary* qualities: by the former, they mean extension, figure, motion, rest, solidity or impenetrability, and number: by the latter, they denote all other sensible qualities, as colours, sounds, tastes, and so forth.—The ideas we have of these they acknowledge not to be the resemblances of any thing existing without the mind, or unperceived; but they will have our ideas of the primary qualities to be patterns or images of things which exist without the mind, in an unthinking substance which they call *matter*. But it is evident that extension, figure, and motion, are only ideas existing in the mind; that without extension solidity cannot be conceived; that an idea can be like nothing but another idea; and that consequently neither they nor their archetypes can exist in an unperceiving substance. Hence it is plain, that the very notion of what is called *matter* or *corporeal substance*, involves a contradiction in it."

171 fallacious.

This account of extension and solidity affords a striking instance how much the most vigorous and upright mind is liable to be warped by prejudice in behalf of a darling theory, and how apt the clearest understanding is to be blinded by the equivocal use of terms. That Bishop Berkeley possessed a vigorous and perspicacious mind, his most vehement antagonists are eager to admit; and that his intentions were good, is known to all Europe. Yet by the equivocal use of the word *idea*, which the writings of Locke had then introduced into the language of philosophy, he has here suffered himself to lose sight of a very proper and accurate distinction, which, so far as we know, was among the moderns first made by himself between *ideas* and *notions*. According to the Bishop, "we have a *notion* of power and a *notion* of spirits, but we can have no *idea* either of the one or the other; for all ideas being passive and inert, they cannot represent unto us by way of image or likeness that which acts. Such is the nature of *spirit* or that which acts, that it cannot be of itself perceived, but only by the effects which it produceth. It must be owned, however, that we have some *notion* of soul, spirit, and the operations of the mind, such as willing, loving, hating, inasmuch as we know or understand the meaning of these words."

Now we beg leave to affirm, that what is here said of spirits, and of which we readily admit the truth, is equally true of material or solid substances. We have no *ideas* of solidity and extension, because these things are not originally impressed upon the senses; but we have very distinct, though relative *notions* of them, for they are clearly perceived by the effects which they produce. That this is at least possible we have the acknowledgment of Bishop Berkeley himself: for he "freely owns, that from a cause, effect, operation, sign, or other circumstance, there may reasonably be inferred the existence of a thing not immediately perceived; and that it were absurd for any man to argue against the existence of that thing, from his having no direct and positive notion of it." This is exactly the case with respect to solid substances. These substances we do not immediately perceive; but we infer their existence from effects, signs, and other circumstances, and we have of them very clear though relative notions. Thus a man can open and shut his empty hand; but when he grasps an ivory ball of three or four inches diameter, he feels, that though the same power be exerted, his hand cannot then be shut. He is conscious that there is no change in himself; and being intuitively certain that every effect must have a cause, he infers with the utmost confidence, that the cause which prevents his hand from shutting is in the ball; or, in other words, that

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that the thing which communicates to his eye the sensation of colour, and impresses upon his hand a sensation of touch, must be solid or impenetrable. Solidity, however, is not the sensation itself; it is only the cause of the sensation; and therefore it is so far from being an idea in our minds, that we are conscious our notion of it is of a thing totally different from all our ideas, of a thing external, at least to our minds. Indeed the notion itself is not positive; it is only relative, and inferred from the effects which are produced on our senses. That it is the *same* thing which communicates to our eye the sensation of colour, and has the power of resisting the compression of our hand, is evident; because, when the ball is thrown away, the resistance as well as the actual sensation vanish at once.

172 The idea of colour and the notion of solidity not naturally inseparable.

From this fact, which a less acute man would think a proof that the resistance was not occasioned by the immediate agency of the Supreme Being, but by the impenetrability of a solid substance of small dimensions, the Bishop argues thus against the *possibility* of such a substance: "They who assert that figure, motion, and the rest of the primary or original qualities, do exist without the mind in unthinking substances, do at the same time acknowledge, that colours, sounds, heat, cold, and such like secondary qualities, do not; which they tell us are sensations existing in the mind alone, that depend on and are occasioned by the different size, texture, and motion, of the minute particles of matter. This they take for an undoubted truth, which they can demonstrate beyond all exception. Now if it be certain, that those original qualities are inseparably united with the other sensible qualities, and not even in thought capable of being abstracted from them, it plainly follows, that they exist only in the mind. But I desire any one to reflect and try whether he can by any abstraction of thought conceive the extension and motion of a body, without all other sensible qualities. For my own part, I see evidently that it is not in my power to frame an idea of a body extended and moved, but I must withal give it some colour or other sensible quality, which is acknowledged to exist only in the mind. In short, extension, figure, and motion, abstracted from all qualities, are inconceivable. Where, therefore, the other sensible qualities are, there must be these also, to wit, in the mind, and no where else."

In this reasoning, though plausible, there is an unintended fallacy. It is indeed true, that we cannot contemplate in imagination a solid substance without conceiving it to have some colour; but there is sufficient reason to believe, that this union of colour and solidity in our minds is not the effect of nature as it operates at first upon our senses, but merely the consequence of early and deep-rooted association. Bishop Berkeley himself has taught us, that the objects of sight are not at a distance; and that if a man born blind were suddenly made to see, he would conceive the objects of his sight as existing either in his eye or in his mind. This is a truth which no man will controvert who has dipt into the science of optics, or who has even paid the slightest attention to the perceptions of infants; and if so, it follows, that to a man born blind and suddenly made to see, colour and solidity would not appear united. Were such a person to lay hold of an ivory ball and raise it to the elevation of his eye, he would perceive whiteness as a new sensation existing in his eye or his mind, but he would feel resistance at the extremity of his arm. He would not have the least reason to conclude, that this whiteness was inseparably united to the cause of this resistance; and he would, in fact, draw no such conclusion, till experience had taught him, that by removing the ball or cause of resistance from his hand, he at the same time removed the sensation from his eye. After repeated experiments, he would indeed discover, that the cause of colour to the eye, was likewise by some means or other the cause of resistance to the hand; and he would so associate these in his mind, that the one would never afterwards make its appearance as an idea or a notion without bringing the other along with it. The whole difficulty, therefore, in this case, is to break an early and deep-rooted association; for it is plain that the associated ideas were not originally united, and that solidity and colour were at first conceived as separate.

If the reader perceive not the force of this reasoning, we beg leave to recommend to him the following experiment, which, if we mistake not, will carry conviction to his judgment, that in the last quoted passage Bishop Berkeley has argued fallaciously, and that extension and colour are not *inseparably* united as ideas in the mind. Let him go into a dark room, containing a number of spherical bodies of various colours; let him take one of them into his hand; and he will instantly *feel* resistance, and have a *notion* of extension and solidity; but will he likewise have the *idea* of colour inseparably united with this notion? The Bishop says he will: and if so, it must be the idea of some *particular* colour; for his Lordship has taught us, that the *abstract* and *general* idea of colour, which is neither *red*, nor *green*, nor *blue*, &c. cannot possibly be formed. The man, then, we shall suppose, whilst he feels resistance, conceives the resisting body to be *green*; and holding it still in his hand, walks into the light of day. The *resistance*, and consequently the *cause* of resistance, remains unchanged; but what becomes of the inseparable union of those with colour, when the body, upon being actually seen, proves to be *black*, i. e. to have no colour at all?—It appears, therefore, undeniable, that solidity and colour are not united in nature; that the one is an essential quality of something external to us, of which we have no *idea*, but a very distinct though relative *notion*; and that the other is an actual sensation in our minds, caused by the impression of something external on the organ of sense, which leaves behind it in the memory or imagination a positive and direct *idea* that exists no where else.

173 Matter exists, but

Solid substance, therefore *may* exist, for though it is not immediately perceived by the senses, and is a thing of which we can have no *idea*, we acquire a clear and distinct *notion* of it, by the very same means which Bishop Berkeley thinks sufficient to give us distinct notions of power and of spirits; and, therefore, that notion can involve in it no contradiction. Still, however, we would not say with Dr Beattie, "that we could as easily believe, that two and two are equal to ten;

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ten; or, that whatever is, is not; as that matter has no separate existence:" for it is certainly *possible*, that the Supreme Being, without the instrumentality of matter, could communicate to our minds all the sensations and motions from which we infer the reality of solid substance. All that we contend for, as having the evidence of demonstration, is the *possibility* of solid and extended substance; and if the thing be *possible*, the general voice of mankind proclaims its *probability*.—We are *conscious* of our actual sensations, and we know by *experience* that they are caused by something distinct from ourselves. When a man grasps an ivory ball, he *feels* that he cannot shut his hand, and he knows that the resistance which prevents him proceeds *not* from *himself*. Thus far all mankind are agreed. But Bishop Berkeley says, that the resistance proceeds immediately from the Supreme Being or some other spirit; whilst we, without pretending that his scheme is impossible, think it more natural to suppose that the man's hand is kept from shutting by the resistance of a solid substance of four inches diameter; of which substance, though we have no *idea* of it, we have as distinct a *notion* as Berkeley had of spirits. From one or other of these causes this effect must proceed; and it is of little importance to life or happiness which of them be the true cause, since it is with the effect only that we are immediately concerned. Still, however, a philosopher would choose to adopt the easiest and most natural side of every alternative; which, if our notion of solidity be just, is certainly, in the present case, the existence of matter.

174 is by some philosophers deemed to be solid.

After treating so largely of the composition of bodies, and showing the general agreement of metaphysicians ancient and modern with respect to the notion of their solidity, it will appear strange to the less philosophical part of our readers, that we should now express a doubt of that notion's being well-founded.—We have ourselves no doubt, but on the contrary are fully convinced, that solidity is essential to matter. This, however, has of late been denied by philosophers of great merit. Dr Priestley, after Mr Mitchell and Father Boscovich, affirms that matter is *not solid* or impenetrable to other matter; and that it has, in fact, no properties but those of *attraction* and *repulsion*‡. The proofs of this position, which appears so paradoxical, he draws from optical experiments, from electricity, and from the effects of heat and cold upon substances usually conceived to be solid.

‡ Disquisitions on Matter and Spirit, and Correspondence with Dr Price.

175 The arguments used in support of this hypothesis.

The appearances from which the solidity of matter is inferred, are nothing more, he says, than superficial appearances, and therefore have led to superficial and false judgments, which the *real appearances* will not authorise. "*Resistance*, on which alone our opinion concerning the solidity or impenetrability of matter is founded, is never occasioned by *solid matter*, but by something of a very different nature, viz. a *power of repulsion*, always acting at a real, and in general an assignable distance, from what we call the body itself. When I press my hand against the table, I naturally imagine that the obstacle to its going through the table, is the *solid matter* of which it consists; but a variety of philosophical considerations demonstrate that it generally requires a much greater power of pressure than I can exert to bring my fingers into actual contact with the table. Electrical appearances show that a considerable weight is requisite to bring into seeming contact even the links of a chain hanging freely in the air, they being kept asunder by a repulsive power belonging to a very small surface, so that they do not actually touch, though they are supported by each other. It has been shown, from optical considerations, that a drop of water rolls upon a cabbage leaf without ever coming into actual contact with it; and indeed all the phenomena of *light* are most remarkably unfavourable to the hypothesis of the solidity or impenetrability of matter. When light is reflected back from a body on which it seems to strike, it was natural to suppose that this was occasioned by its impinging against the *solid parts* of the body; but it has been demonstrated by Sir Isaac Newton, that the rays of light are always reflected by a *power of repulsion* acting at some distance from the body. Again, when part of a beam of light has overcome this power of repulsion, and has entered any transparent substance, it goes on in a right line, provided the medium be of an uniform density, without the least interruption, and without a single particle being reflected, till it comes to the opposite side, having met with no solid particles in its way, not even in the densest transparent substances, as glass, crystal, or diamond; and when it is arrived at the opposite side, it is solely affected by the laws of attraction and repulsion.

"Nay, that the component particles of the hardest bodies themselves do not actually touch one another, is demonstrable from their being brought nearer together by cold, and by their being removed farther from each other by heat. The power sufficient to overcome these internal forces of repulsion, by which the ultimate particles of bodies are prevented from coming into actual contact, is what no person can pretend to compute. The power requisite to break their cohesion, or to remove them from the sphere of each other's attraction, may in some measure be estimated; but this affords no *data* for ascertaining the force that would be necessary to bring them into actual contact, which may exceed the other almost infinitely."

From these facts, Dr Priestley infers, that the mutual resistance of bodies proceeds in all cases from powers of repulsion acting at a distance from each body: that the supposition of the *solidity* or *impenetrability* of matter is destitute of all support whatever; and that matter itself is nothing but powers of attraction and repulsion, and several spheres of them, one within another. As other philosophers have said, "Take away solidity, and matter vanishes;" so he says expressly, "Take away attraction and repulsion, and matter vanishes."

To illustrate this strange notion, "Suppose (says he) that the Divine Being, when he created *matter* only fixed certain *centres of various attractions and repulsions*, extending indefinitely in all directions, the whole effect of them to be upon each other; these centres approaching to, or receding from each other; and consequently carrying their peculiar spheres of attraction and repulsion along with them, according to certain definite circumstances. It cannot be denied that these spheres may be diversified infinitely, so as to correspond to all the kinds of bodies that we are acquainted with, or that are possible. For all effects in which

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bodies are concerned, and of which we can be sensible by our eyes, touch, &c. may be resolved into attraction or repulsion. A compages of these centres, placed within the spheres of each others attraction, will constitute a body that we term *compact;* and two of these bodies will, on their approach, meet with a repulsion or resistance sufficient to prevent one of them from occupying the place of the other, without a much greater force than we are capable of employing; so that to us they will appear perfectly hard.

"As, in the constitution of all actual bodies that we are acquainted with, these centres are placed so near to each other, that in every division that we can make we still leave parts which contain many of these centres; we, reasoning by analogy, suppose that every particle of matter is infinitely divisible; and the *space* it occupies is certainly so. But, strictly speaking, as those centres which constitute any body are not absolutely infinite, it must be naturally possible to come by division to one single centre, which could not be said to be divisible, or even to occupy any portion of space, though its sphere of action should extend ever so far; and had only *one* such centre of attraction, &c. existed, its existence could not have been known, because there would have been nothing on which its action could have been exerted; and there being no *effect*, there could not have been any ground for supposing a *cause*."

In answer to this reasoning against the solidity of matter, Dr Priestley was frequently asked by his candid and masterly antagonist *, "What it is that attracts and repels, and that is attracted and repelled?" But to the question he was never able to give a satisfactory answer. Indeed, how could he have been able? for, as Dr Price argues, "Exclusive of attraction and repulsion, he affirms matter to be absolutely nothing; and therefore, though we were to allow it the power of attracting and repelling, yet as it is nothing but this power, it must be the power of nothing, and the very idea of it be a contradiction."

* Free Discussion between Dr Price and Dr Priestley.

176 founded on fallacious appearances and contrary to an intuitive and necessary truth.

If there be any class of truths intuitively certain, that class comprehends the two following propositions: POWER CANNOT BE WITHOUT A SUBJECT; and NOTHING CAN ACT WHERE IT IS NOT. If, therefore, there be powers of attraction and repulsion, (which shall be considered afterwards in the chapter of MOTION), there must be a subject of those powers; and if matter, whether solid or unsolid, be the subject, it cannot possibly attract or repel at a *distance*. Sir Isaac Newton, in his letters to Dr Bentley, calls the notion that matter possesses an innate power of attraction, or that it can act upon matter at a distance, and attract and repel by its own agency, "an absurdity into which, he thought no one could possibly fall." Hence it follows, that the appearances from which Dr Priestley infers the penetrability of matter must be fallacious appearances, since they contradict an intuitive and necessary truth. The facts which he instances are, indeed, such as would make most other men suspicious of fallacy, and in his reasonings from them he sometimes takes for granted the truth to be proved. The links of a chain used for electrical purposes, supposing them to be in contact with each other, can touch only with very small surfaces. The electrical fluid is of considerable density, and incapable of being absorbed within a very narrow compass. This is evident, because it passes not through paper and other porous bodies without making a passage for itself, and leaving a visible aperture behind it; and though it assimilates with metals, and passes through them more easily than through other bodies, yet it is plain that it requires a certain quantity of metal to conduct it; for when the conductor falls short of the necessary quantity, it is melted or dissipated by the force of the fluid. This being the case, it follows that the links of a chain *may be* in actual contact (we do not positively affirm that they *are*), and yet the fluid become visible in passing from link to link; for if the point of contact be too small to absorb the *whole* fluid, *part* of it must pass without any metallic conductor through the atmosphere, and thus become apparent to the eye of the spectator.

With respect to light, it is obvious that there cannot possibly be any *demonstration*, in the logical sense of the word, that it is reflected by a power of repulsion acting at some distance from the body; for, in the opinion of all mankind, the primary and solid atoms of matter are too minute to fall under the cognisance of our senses, however assisted by art; and therefore, if light *appears* to be reflected at a distance from the surface of the body, we must conclude, either that between the point of reflection and the apparent surface of the body, there are solid atoms unperceived by us, or that light is reflected by the agency of some other substance than matter. One of these conclusions, we say, *must* be drawn, because they are both *possible*, and there is no other alternative but to admit one of them, or to suppose that a thing may act where it is not; which is as clearly absurd and *impossible* as that *whatever is, is not*. Again, when part of a beam of light has entered any transparent substance, how does Dr Priestley know that it goes on in a right line, without the least interruption, till it comes to the opposite side? This he can know only by his senses; but the beam may meet with ten thousand interruptions from objects which the senses cannot perceive, and may describe a zig-zag line, of which the deflections are so small as to elude the keenest eye aided by the most powerful glass.

That the component particles of the hardest bodies do not *all* actually touch one another, is indeed evident from the effects of cold and heat upon those bodies: but it does not therefore follow that those bodies have no component particles; but only, that they are fewer in number than we are apt to imagine; that all the solid matter in the universe might possibly be compressed within a very narrow sphere; and that it is held together in different bodies and different systems by a power foreign from itself. These are truths which all philosophers have admitted who have thought sufficiently on the subject; but who will admit Dr Priestley's proposition, when it is translated into common English: "That the component *nothings* of the hardest bodies do not actually touch one another, is demonstrable from their being brought nearer together by cold, and by their being removed farther from each other by heat?"

Dr Priestley owns, that if matter be solid it could act upon other matter by impulse. We are certain, that, whatever it be, it can act upon nothing in the manner

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177 Our most adequate notion of matter.

manner which he describes; and therefore, to use the words of Dr Price, "matter, if it be any thing at all, must consist of solid particles or atoms occupying a certain portion of space, and therefore *extended*, but at the same time *simple* and *uncompounded*, and incapable of being resolved into any other smaller particles. It must likewise be the different form of these *primary* particles, and their different combinations and arrangement, that constitute the different bodies and kinds of matter in the universe." This is exactly agreeable to the doctrines of Newton; who, after considering the question in every point of view, concludes, that "in the beginning God formed matter in solid, massy, hard, impenetrable, moveable particles, of such sizes and figures, and with such other properties, as most conduced to the end for which he formed them; and that those primary particles being solid, are incomparably harder than any porous bodies compounded of them; even so very hard as never to wear or break in pieces: no ordinary power being able to divide what God himself made one in the creation." To talk, as Dr Priestley does, of matter's being certain *centres of various attractions and repulsions* extending indefinitely in all directions, and to describe these centres as *not* being *physical points* or *solid atoms*, is either to say, that *nothing* attracts and repels; or it is to introduce the divine agency as the immediate cause of all our sensations. The former of these alternatives Dr Priestley disclaims; the latter he seems willing to admit. But if it be his meaning that all our sensations are caused by the immediate agency of God or created spirits, his scheme differs not from that of Berkeley, except in being less elegantly expressed and less ingeniously supported. Berkeley's scheme is evidently *possible*. The commonly received scheme is likewise possible. It remains therefore with the reader, whether he will adopt the system of the Bishop of Cloyne; or admit, with all other philosophers, that matter exists; that it consists of parts actually distinct and separable; and that each of these parts is a *monad* or solid atom, which requires no foreign agency to keep it united.

Chap. IV. *Of* Space *and its* Modes.

178 The necessary adjuncts of body, what.

Having considered bodies in their substance, essences, and qualities, and proved that they have a real existence independent of us and our conceptions, we proceed now to inquire into the nature of *space*, *motion*, *number*, and *duration*. These are commonly called the *adjuncts* of body, and are supposed to be absolutely inseparable from its existence. It does not indeed appear that *actual motion* is a necessary adjunct of body, considered as a mere solid, extended, and figured substance; but it is certainly necessary to the existence of organized and animated bodies; and the capability of being moved enters into our conceptions of all bodies whatever. Of these adjuncts, that which first demands our attention is *space*; for without a knowledge of its nature we could not have an adequate idea of motion, and without motion we could have no idea of time.

179 Our notion of space, how acquired.

Every body is extended; and between two bodies not in actual contact, we perceive that a third body may be easily introduced. That which admits of the introduction of the third body is what we call *space*: and if it be totally void of matter, it is called *pure space*. Whether there be any space absolutely pure, has been disputed; but that such space is possible, admits of no dispute. Were any one body (a cannon ball for instance) to be annihilated, and the circumambient air, with every other material substance, kept from rushing into the space which the ball had occupied, that portion of space, with respect to matter, would be empty or pure space: whether it would necessarily be filled with mind shall be considered afterwards. Pure space, therefore, is conceivable; and it is conceived as having three dimensions, length, breadth, and depth, which are generally called the three simple modes of space. In this respect it agrees with body: but the agreement proceeds no farther; for space is conceived as destitute of solidity, without which the existence of body is inconceivable. It has been formerly observed, that whatever may be distinctly conceived may possibly exist; but with respect to the existence of pure space, whatever is possible is real: for it shall be shown in the next section, that were there no space absolutely pure or void of matter, there could be no motion. Our business at present is to inquire what the nature of space is, and what notion we ought to have of its existence.

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180 Space supposed to be something different from body and mind, and to be eternal and infinite, &c.

Many modern philosophers consider space as something entirely distinct both from body and mind: some of them ascribe to it no less than four of the attributes of the Deity—*eternity*, *immobility*, *infinity*, and *necessary existence*; and a few of them have gone so far as to call *infinite space* the *sensorium* of the Deity. "The supposal of the existence of *any thing whatever* (says Dr Clarke *) necessarily includes a *presupposition* of the existence of *space*. Nothing can possibly be conceived to exist without thereby presupposing space; which, therefore, I apprehend to be a *property* or *mode* of the self-existent Substance; and that, by being evidently necessary itself, it proves, that the substance of which it is a property must be also necessary." Elsewhere he says, that "space is a property or mode of the self-existent Substance, but not of any other substances. All other substances are *in* space, and are *penetrated* by it; but the self-existent Substance is not in space, nor penetrated by it, but is itself (if I may so speak) the *substratum* of space, the *ground* of the Existence of *space* itself." He acknowledges, however, that such expressions as "the self-existent Substance is the *substratum* of space, or space is a property of the self-existent Substance, are *not*, perhaps, very proper: but what I mean (says he), is this: The idea of *space* (as also of *time* or *duration*) is an abstract or partial idea; an idea of a certain *quality* or *relation*, which we evidently see to be necessarily existing; and yet (which not being itself a *substance*) at the same time necessarily *presupposes* a substance, without which it could not exist."

Demonstration of the Being and Attributes of God, and Correspondence with a Gentleman in Gloucestershire, passim.

These opinions respecting space have been adopted by succeeding philosophers of great merit, and particularly by Dr Price; who says, that "it is a maxim which cannot be disputed, that *time* and *place* are necessary to the existence of all things. Dr Clarke (continues he) has made use of this maxim, to prove that infinite space and duration are the essential properties of the Deity; and I think he was right."

Had authority any weight in philosophy, we know not what modern writers we could oppose to the celebrated

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brated names of Clarke and Price, unless it were Bishop Berkeley, Dr Law late bishop of Carlisle, and the author of Ancient Metaphysics. But the question is not to be decided by authority. Learned and acute as Dr Clarke was, his assertions respecting space are contradictory and inconsistent. If nothing can possibly be conceived to exist without thereby presupposing the existence of *space*, how can space be a property or mode of the self-existent substance? Are properties prior in the order of nature, or even in our conceptions, to the substances in which they inhere? Can we frame an abstract idea of figure, or extension, or solidity, before we conceive the existence of any one figured, extended, or solid substance? These are questions which every man is as capable of answering as the Doctors Clarke and Price, provided he can look attentively into his own mind, and trace his ideas to their source in sensation: and if he be not biassed by the weight of great names, we are persuaded he will find, that if it be indeed true, that the supposal of the existence of any thing whatever necessarily includes a *presupposition* of the existence of space, *space* cannot possibly be a *property* or *mode* of the self-existent substance, but must of necessity be a *substance* itself.

181 This supposition controverted.

182 Space necessary to the existence of every thing.

It is, however, *not* true, that the supposal of the existence of any thing whatever necessarily includes a presupposition of the existence of space. The idea of space is indeed so closely associated with every visible and most tangible objects, that we cannot see the one nor feel the other without conceiving them to occupy so much of space. But had we never possessed the senses of sight and touch, we could not have supposed the existence of space necessary to the existence of any thing whatever. The senses of smelling, tasting, and hearing, together with our internal powers of consciousness and intellect, would certainly have compelled us to believe in our own existence, and to suppose the existence of other things; but no object either of consciousness, smelling, tasting, or hearing, can be conceived as occupying space. Space and every thing which fills it are conceived as of three dimensions; but who ever supposed or can suppose an *odour*, *taste*, or *sound*, to have *length*, *breadth*, and *depth*; or an object of consciousness to be an ell or an inch long?

Let us suppose that body and all the visible world had a beginning, and that once nothing existed but that Being which is alone of necessary as well as eternal existence; *space*, say the followers of Dr Clarke, would then exist likewise without bounds or limits. But we desire to know of these gentlemen what sort of a being this space is. It certainly is not *substance*; neither is it a property; for we have seen that the very notions of it, which lead men to suppose its existence *necessary*, render it impossible to be a property of the self-existent Being. Is it then nothing? It "is in one sense*: it is nothing *actually* existing; but it is something *potentially*; for it has the *capacity* of receiving body whenever it shall exist. It is not, and cannot, become any thing itself, nor hath it any actual existence; but it is that without which nothing corporeal could exist." For this reason it was that Democritus and Epicurus made space one of the principles of nature; and for the same reason Aristotle has made *privation* one of his three principles of natural things, *matter* and *form* being the other two. But though the privation of *one* form be doubtless necessary before matter can receive another (for a piece of wax or clay cannot receive the form of a *globe* before it lose the form of a square), yet Aristotle never dreamed that the privation of the square was any property of the globe, or that *privation* itself was to be reckoned a real being. On the contrary, he expressly calls it τὸ μὴ ὄν, or *the no being*. In this way, if we please, we may consider space, and call it the *privation of fulness* or of body. We have indeed a positive idea of it, as well as of silence, darkness, and other privations: but to argue from such an idea of space, that space itself is something real, seems altogether as good sense as to say, that because we have a different idea of *darkness* from that of *light*, of *silence* from that of *sound*, of the *absence* of any thing from that of its *presence*; therefore *darkness*, *silence*, *absence*, must be real things, and have as positive an existence as *light*, *sound*, and *body*: and to deny that we have any positive idea, or, which is the very same thing, any idea at all, of the privations abovementioned, will be to deny what is capable of the most complete proof (see n° 19.), and to contradict common sense and daily experience. There are therefore ideas, and simple ones too, which have nothing *ad extra* correspondent to them; no proper *idiatum*, archetype, or objective reality: and we do not see why the idea of space may not be reckoned of that number. To say that *space* must have existence, because it has some properties (for instance, *penetrability*, or the *capacity* of receiving body), seems† to be the same thing as to urge that *darkness* must be *something* because it has the capacity of *receiving light*; *silence* the property of admitting *sound*; and *absence* the property of being supplied by *presence*. To reason in this manner is to assign absolute negations; and such as, in the same way, may be applied to *nothing*, and then call them *positive properties*; and so infer that the chimera, thus cloathed with them, must needs be *something*.

* Ancient Metaphysics.

† See Notes on King's Origin of Evil, and Law's Enquiry into the Ideas of Space, &c.

183 Space nothing but the possible existence of body.

But it is said, that as we cannot conceive space to be annihilated, it must be some real thing of eternal and necessary existence. If this argument had not been used by writers of great merit, and with the best intention, we should not have scrupled to call it the most contemptible sophism that ever disgraced the page of philosophy. Whatever now has an *actual* existence, must from eternity have had a *possible* existence in the ideas of the Divine mind. Body, as an extended substance, has now an *actual* existence; and therefore it must from eternity have had a *possible* existence in the ideas of the Divine mind: but the *possible existence of body* is all that we can conceive by *space*; and therefore this argument, upon which so much stress has been laid, amounts to nothing more, than that what has from eternity been possible, can at no period have been impossible. It is evident that the *capacity* or *potentiality* of every thing existing must have been from eternity; but is capacity or potentiality a real being? All the men and women who shall succeed the present generation to the end of time, have at this moment a possibility of existence, nor can that possibility be conceived as an impossibility; but is it therefore any thing actually existing either as a substance or a quality?

It has been urged, that space must be something more than the mere absence of matter; because if nothing

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thing be between bodies, such as the walls of a room, they must necessarily touch. But surely it is not *self-evident* that bodies must necessarily touch if nothing be between them; nor of the truth of this proposition can any thing like a proof be brought. It is indeed intuitively certain, that "things, when they are in contact, have nothing between them;" and hence it has been rashly inferred, that things, when they have nothing between them, are in contact; but this is an illegitimate conversion of the proposition. Every logician knows, that to convert a proposition, is to infer from it another whose *subject* is the *predicate*, and whose *predicate* is the *subject*, of the proposition to be converted: but we are taught by Aristotle and by common sense, that an *universal* affirmative can be converted only into a *particular* affirmative. "Things, when they are in contact, have nothing between them," is an *universal* affirmative proposition; and therefore it can be converted only into the following *particular* affirmative: "Some things, when they have nothing between them, are in contact;" a proposition which by no means includes in it the contact of the walls of an empty room. The reason why the walls of an empty room do not touch, is that they are *distant;* but is *distance*, in the abstract, any thing really existing? Two individuals differ, or there is a difference between them; but is *difference* itself any real external thing? Bodies are long, broad, thick, heavy; but are *length*, *breadth*, *density*, *weight*, properly any thing? Have they any real separate archetypes or external idiata? Or can they exist but in some substance?

184 The fallacy which led to the supposition that space is a real thing.

The reason why so many philosophers have considered space as a real external thing, seems to be this: Every bodily substance is extended; but space is conceived to be that which contains body, and therefore to space we likewise attribute extension. Extension is a quality which can have no existence but as united with other qualities in some substance; and it is that of which, abstracted from all substances, we can, properly speaking, form no *idea*. We understand the meaning of the word, however, and can reason about that which it denotes, without regarding the particular substance in which extension may inhere; just as we can reason about whiteness without regarding any one white object, though it is self-evident that whiteness, abstracted from all objects, cannot figure in the mind as an idea. Qualities considered in this manner are general and relative notions, the objects of pure intellect, which make no appearance in the imagination, and are far less, if possible, to be perceived by sense: but it is extremely painful to the mind to dwell upon such notions; and therefore the ever-active fancy is always ready to furnish them with imaginary *substrata*, and to make that which was a *general* and *invisible notion* be conceived as a *particular ideal object*. In the case of extension this is the more easily done, that the notion which we have of a *real substratum* or substance, the support of real qualities, is obscure and relative, being the notion of *something* we know not what. Now, by leaving, if we can, solidity and figure out of our conception, and joining the notion of *something* with the notion of *extension*, we have at once the *imaginary substratum* of an *imaginary* quality, or the general notion of extension particularised in an imaginary subject; and this subject we call *space*, vainly fancying that it has a real external and independent existence. Whether this be not all that can be said of space, and whether it be not absurd to talk of its having any real properties, every man will judge for himself, by reflecting upon his own ideas and the manner in which they are acquired. We ourselves have no doubt about the matter. We consider pure space as a mere notion relative to the existence of corporeal substance, as nothing more than the absence of body, where body is possible; and we think the usual distinction between *absolute* and *relative* space, if taken as real, the grossest absurdity. We do not, however, pretend to dictate to others; but recommend it to every man to throw away all respect for great names, to look attentively into his own thoughts, and on this as on all metaphysical subjects to judge for himself.

185 Place, what it is.

Having said so much of space in general, we need not waste much time upon its modes. Indeed the only mode of space, after considering it with respect to the three dimensions of body, which now demands our attention, is that which we call *place*. As in the simplest mode of space we consider the relation of distance between any two bodies or points; so, in our idea of *place*, we consider the relation of distance betwixt any thing, and any two or more points, which, being considered as at rest, keep the same distance one from another. Thus, when we find any thing at the same distance now at which it was yesterday from two or more points with which it was then compared, and which have not since the comparison was made changed their distance or position with respect to each other, we say that the thing hath kept its *place*, or is in the *same place;* but if it hath sensibly altered its distance from either of those points, we then say that it hath changed its *place*.

From this view of the nature of place, we need not observe that it is a mere relation; but it may be worth while to advert to this circumstance, that a thing may without falsehood be said to have continued in the same place, and at the same time to have changed its place, according to the different objects with which it is compared. Thus, if two persons find a company of chess-men standing each upon the same square of the chess-board where they left them, the one may with truth affirm that they are all in the *same place*, or unmoved; and the other may with equal truth affirm that they have all changed *place*. The former considers the men only with respect to their distances from the several parts of the chess-board, which have kept the same distance and position with respect to one another. The latter must consider the men with respect to their distance from something else: and finding that the chess-board, with every thing upon it, has been removed, we shall suppose from one room to another, he cannot but say that the chess-men have changed their place with respect to the several parts of the room in which he formerly saw them.

This modification of distance, however, which we call *place*, being made by men for their common use, that by it they may design the particular position of objects where they have occasion for such designation, they determine this *place* by reference to such adjacent things as best serve their present purpose, without regarding other things which, for a different purpose, would better determine the place of the same object.

Thus

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Thus in the chess-board, the use of the *designation of the place* of each chess-man being determined only within that chequered piece of wood, it would cross that purpose to measure it by any thing else: but when these very chess-men are put up in a box, if any one should ask where the black king is, it would be proper to *determine the place* by reference to something else than the chess-board; such as the parts of the room or closet which contain the box.

186 The universe has no place.

That our idea of *place* is nothing but such a relative position of things as we have mentioned, will be readily admitted, when it is considered that we can have no idea of the place of the *universe*. Every *part* of the universe has place; because it may be compared with respect to its distance from other parts supposed to be fixed. Thus the earth and every planet of our system has a place which may be determined by ascertaining its distance from the sun and from the orbits of the other planets; and the place of the system itself may be ascertained by comparing it with two or more fixed stars: but all the systems taken as *one whole* can have no *place;* because there is nothing else to which the distance and position of that whole can be referred. It is indeed true, that the word *place* is sometimes used, we think improperly, to denote that *space* or portion of *space* which any particular body occupies; and in this sense, no doubt, the universe has place, as well as the earth or solar system: but to talk of the place of the universe in the other and proper sense of the word, is the grossest nonsense.

Chap. V. *Of* Motion.

187 Mobility essential to every corporeal substance, but not natural motion.

Mobility, or a capacity of being moved, is essential to every corporeal substance; and by actual motion are all the operations of nature performed. Motion, therefore, if it may be called an *adjunct* of body, is certainly the most important of all its adjuncts; and to ascertain its nature and origin demands the closest attention of the metaphysician, as well as of the mechanic and astronomer. With the *laws* of motion, as discovered by experience, we have at present no concern; they are explained and fully established in other articles of this work (see Mechanics, Motion, &c.). The principal questions which we have to consider are, "What is motion? and, By what power is it carried on?"

For an answer to the first of these questions, the modern metaphysician refers every man to his own senses; because, in his apprehension, the word motion denotes a simple idea which cannot be defined. Among the ancients, the Peripatetics were of a different opinion; and Aristotle, whose love of dialectic made him define every thing, has attempted to give two definitions of *motion*. As some learned men are at present labouring to revive this system, we shall, out of respect to them, mention those definitions, and make upon them such remarks as to us appear proper.

188 The Peripatetic definitions of motion

The author of *Ancient Metaphysics* having observed, that both nature and art propose some end in all their operations; that when the end is obtained, the thing operated upon is in a state of perfection or completion; and that in the operations of both nature and art there is a progress, and by consequence a *change*, from one thing to another; adds, that this change is *motion*. Motion, therefore, according to him, is a change or progress to the end proposed, or to that state of perfection or completion which Aristotle calls εντελεχεια. It is not enough, however, that we know *to what* the change or progress is made: to have an adequate idea of motion, we must likewise know *from what* it proceeds. Now it is evident that every thing existing, whether by nature or art, was, before it existed, possible to exist; and therefore, adds the same author, things do in some sort exist even before they exist. This former kind of existence is said by Aristotle to be εν δυναμει, that is, in *power* or *capacity*. In this way, plants exist in their seeds; animals in the embryo; works of art in the idea of the artists and the materials of which they are made; and, in general, every thing in the causes which produce it. From this power or capacity there is a progress to *energy* or actual existence; so that we are now able to answer the question, "*from what*, and *to what*, motion is a change?" for it is universally true of all *motion*, that it is a change from *capacity* to *energy*.

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"Having thus discovered that *motion* lies betwixt *capacity* and *energy*, it is evident (he says) that it must have a connection with each of them: and from this double connection Aristotle has given us two definitions of it; one of them taken from the *energy*, or end to which it tends; the other from the *capacity* from which it begins. The first is expressed in two words, viz. ενεργεια ατελης or *imperfect energy;* the other is εντελεχεια του εν δυναμει ῃ εν δυναμει; which may be translated thus, *The perfection of what is in capacity, considered merely as in capacity.* The meaning of the last words is, that nothing is considered in the thing that is moved but merely its *capacity;* so that motion is the perfection of that capacity, but not of the thing itself. It is something more (adds the learned author) than mere *capacity;* for it is capacity exerted, which when it has attained its end, so that the thing has arrived at that state to which it is destined by nature or art, ceases, and the thing begins to exist ενεργεια, or *actually*."

189 unintelligible.

By all the admirers of Aristotle, this latter definition has been preferred to the former; for what reason, it is difficult to say. They both involve in the thickest obscurity that which, viewed through the senses, is very easily understood; and on this, as on many other occasions, Aristotle was certainly guilty of darkening counsel by words without knowledge. The author, whose comment on this wonderful definition we have faithfully abridged, admits that it is not intelligible till we know what *change* and *progress* are; but is it possible to conceive any *change* to take place in bodily substances without *motion?* or, if we were called upon to explain what progress is, could we do it better than by saying that it is motion *from* something *to* something? It is likewise very obvious, that before we can have an adequate idea of *motion*, we must, according to this definition, know perfectly what the words *capacity*, *energy*, and *perfection* denote; and yet nothing can be more true than that *perfection* denotes a complex conception, which may be easily defined by resolving it into the simple ideas and notions of which it is compounded, whilst *motion* is susceptible of no such resolution. The perfection of a knife is compounded of the temper of the steel and the

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the sharpness of the edge: the perfection of a system of philosophy consists of the importance of the subjects treated, the strength of the author's arguments, and the perspicuity of his style and manner; but of what is the *motion* of a ball, or *an atom*, or any thing else, compounded? We are aware that to this question the modern Peripatetics will reply, that it is not the motion of a *ball*, or an *atom*, or any *one thing*, that their master has so learnedly defined, but motion abstracted from *all individuals*, and made an object of pure intellect; and they will likewise affirm, that by the word *perfection* used in the definition, he does not mean *any one kind* of perfection as adapted to any particular *object* or *end*, but perfection abstracted from *all objects* and *all ends*. The perfection of *nothing* and the motion of *nothing*, for such surely are that motion and that perfection which are abstracted from *all objects* and *ends*, are strange expressions. To us they convey no meaning; and we have reason to think that they are equally unintelligible to men of greater acuteness (o). In a word, *motion* must be seen or felt; for it cannot be defined. To call it the *act of changing place*, or a *passage from one place to another*, gives no information; for *change* and *passage* cannot be conceived without previously conceiving *motion* (p).

190 The Peripatetic division of motion absurd.

The Peripatetics having idly attempted to *define* motion, proceed next to *divide* it into four kinds or classes. This division was by the father of the school pretended to be made from the effects which it produces, and was said by him to belong to three categories, viz. *quality*, *quantity*, and *where* (see CATEGORY). The first kind is that well known *motion* from *place* to *place*, which falls under the category last mentioned; the second is *alteration*, by which the quality of any thing is changed, the substance remaining the same. This belongs to the category of *quality*. The third is *increase*, and the fourth *diminution*, both belonging to the category of *quantity*. The ancient atomists; and all the modern metaphysicians of eminence, have with great propriety rejected this division as being nothing but a collection of absurd distinctions where there is in nature no difference. It has been already shown, that body has no other real qualities than *solidity*, *extension*, and *figure*: but of these the first cannot be altered without destroying the substance; for every thing which is material is equally solid. The extension of a body may indeed be enlarged, and its figure may be altered, while the substance remains the same; but that alteration can be made only by moving from their *places* the solid atoms of which the body is composed. Aristotle's second kind of motion therefore differs not from the first; nor do the third and fourth differ from these two. For a body cannot be *increased* without acquiring new matter, nor diminished without losing some of the matter of which it was originally composed: but matter can neither be added nor taken away without motion from place to place; for there is now no creation *de novo*; and we have no reason to imagine that, since the original creation, a single atom has been ever annihilated. It is therefore past dispute, that local motion is the only motion conceivable; and indeed, as far as we are capable of judging from what we know of body, it is the only motion possible.

191 Whether, if but one body existed, there could be motion?

This has given rise to a question which has been debated among modern philosophers, though, as far as we know, it was never agitated among the ancients, viz. "Whether if there were but one solid body existing, that body could possibly be moved." Bishop Berkeley seems to be of opinion that it could not; because no motion can be conceived but what has a direction towards some *place*, and the relation of place necessarily supposes the existence of two or more bodies. Were all bodies, therefore, annihilated except one globe, it would be impossible (he thinks) to conceive that globe in motion (q). With respect to the

(o) "Nunc dicendum de natura motus. Atque is quidem, cum sensibus clare percipiatur, non tam natura sua, quam doctis philosophorum commentis obscuratus est. Motus nunquam in sensus nostros incurrit sine mole corporea, spatio et tempore. Sunt tamen qui motum, tanquam ideam quandam simplicem et abstractam, atque *ab omnibus aliis rebus sejunctam*, contemplari student. Verum idea illa tenuissima et subtilissima *intellectus aciem eludit*: id quod quilibet secum meditando experiri potest. Hinc nascuntur magnæ difficultates de natura motus, et definitiones, ipsa re quam illustrare debent longe obscuriores. Hujusmodi sunt definitiones illæ Aristotelis et scholasticorum, qui motum dicunt esse *actum mobilis quatenus est mobile*, vel, *actum entis in potentia quatenus in potentia*. Hujusmodi etiam est illud viri inter recentiores celebris, qui asserit *nihil in motu esse reale præter momentaneum illud quod in vi ad mutationem nitente constitui debet*. Porro constat, horum et similium definitionum auctores in animo habuisse abstractam motus naturam, seclusa omni temporis et spatii consideratione, explicare: sed qua ratione abstracta illa motus quintessentia (ut ita dicam) intelligi possit non video."

Berkeley de Motu.

(p) "Multi etiam per *transitum* motum definiunt, obliti scilicet transitum ipsum sine motu intelligi non posse, et per motum definiri opportere: Verissimum adeo est definitiones, sicut nonnullis rebus lucem, ita vicissim aliis tenebras affere. Et profecto, quascumque res sensu percipimus, eas clariores aut notiores definiendo efficere vix quisquam potuerit. Cujus rei vana pe allecti res faciles difficillimas reddiderunt philosophi, mentesque suas difficultatibus, quas ut plurimum ipsi peperissent, implicavere." *Id. ibid.*

(q) Having proved that *place*, in the proper sense of the word, is merely relative, and affirmed that all *motion* is relative likewise, the Bishop proceeds thus: "Veruntamen ut hoc clarius appareat, animadvertendum est, motum nullum intelligi posse sine determinatione aliqua seu directione, quæ quidem intelligi nequit, nisi præter corpus motum, nostrum etiam corpus, aut aliud aliquid, simul intelligatur existere. Nam sursum, deorsum, sinistrorsum, dextrorsum, omnesque plagæ et regiones in relatione aliqua fundantur, et necessario corpus a moto diversum connotant et supponunt. Adeo ut, si, reliquis corporibus in nihilum redactis, globus, exempli gratia, unicus existere supponatur; in illo motus nullus concipi possit: usque adeo necesse est, ut detur

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the origin of our *ideas* of motion, his reasoning appears unanswerable; but we do not perceive how it concludes against the possibility of motion itself as existing in a single body. It has been already shown in the chapter of *simple apprehension and conception*, that though nothing can be conceived which may not possibly exist, yet many things may be possible which we have not faculties or means to conceive. In the present instance, were this solitary globe animated as our bodies are, were it endowed with all our senses and mental powers, it certainly would not acquire any *idea* of motion though impelled by the greatest force. The reason is obvious; it would have no objects with which to compare its place and situation at different periods of time; and the experience of a ship at sea in calm weather, affords sufficient proof that motion which is equable cannot be perceived by any other means than by such a comparison. When the waves swell and the ship pitches, it is indeed impossible that those who are on board should not perceive that they are actually in motion; but even this perception arises from comparing their position with that of the waves rising and falling around them: whereas in the regions of empty space the animated globe could compare its position with nothing; and therefore, whether impelled by equal or unequal forces, it could never acquire the *idea* of motion. It may perhaps be thought, that if this solitary globe were a *self*-moving animal, it might acquire the *idea* of motion by inferring its existence from the energy which produced it. But how, we would ask, could an animal in such circumstances be *self*-moving? Motion is the effect of some cause; and it has been already shown (see n° 118. of this article), that we have no reason to suppose that any being can be the *real* and *primary* cause of any effect which that being can neither conceive nor will: but as motion can be perceived only by the senses, a solitary animal could have no idea of motion previous to its own exertions; and therefore could neither conceive, nor will, an exertion to produce it. Let us, however, suppose, that without any end in view it might spontaneously exert itself in such a manner as would produce *sensible* motion, were it surrounded with other corporeal objects; still we may venture to affirm, that so long as it should remain in absolute solitude, the being itself would acquire no *idea* of motion. It would indeed be *conscious* of the *mental* energy, but it could not infer the existence of motion as a consequence of that energy; for the idea of motion can be acquired only by sense, and by the supposition there are no objects from which the senses of this spherical animal could receive those impressions, without which there can be no perception, and of course no ideas.

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192 Answered in the affirmative.

Let us now suppose, that, while this animated globe is under the influence either of external impulse or its own spontaneous energy, other bodies are suddenly brought into existence: would it then acquire the idea of motion? It certainly would, from perceiving its own change of place with respect to those bodies; and though at first it would not perhaps be able to determine whether itself or the bodies around it were moving, yet a little experience would decide this question likewise, and convince it that the motion was the effect either of its own *mental energy*, or that external *impulse* which it had felt before the other bodies were presented to its view. But it is obvious, that the creation of new bodies at a distance, can make no real alteration in the state of a body which had existed before them: and therefore, as this animated globe would now *perceive* itself to be moving, we may infer with the utmost certainty, that it *was moving* before; and that the motion of a single body, though not *perceivable* by the senses, might possibly be produced in empty space.

193 Whether motion would be possible in space absolutely full?

Having thus seen that a single body is capable of motion in empty space, the next question that occurs on this subject is, Whether it would be possible to move a body in space that is absolutely full? Such are the terms in which this question is usually put; and by being thus expressed, it has given rise to the dispute among natural philosophers about the existence of a *vacuum*. Perhaps the dispute might have been avoided had the question been more accurately stated. For instance, had it been asked, Whether motion would be possible, could matter be supposed absolutely infinite without any the least interstice or vacuity among its solid parts? we apprehend that every reflecting man would have answered in the negative. At any rate, the question ought to be thus stated in metaphysics; because we have seen that space, though a positive term, denotes nothing really existing. Now it being of the very essence of every solid substance to exclude from the place which it occupies every other solid substance, it follows undeniably, that not one particle of an infinite solid could be moved from its place without the previous annihilation of another particle of equal extent; but that annihilation would destroy the infinity. Were matter extended to any degree *less* than infinity, the motion of its parts would undoubtedly be possible, because a sufficient force could separate those parts and introduce among them vacuities of any extent; but without vacuities capable of containing the body to be moved, it is obvious that no force whatever could produce motion. This being the case it follows, that however far we suppose the material universe extended, there must be vacuities

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detur aliud corpus, cujus situ motus determinari intelligatur. Hujus sententiæ veritas clarissima elucebit, modo corporum omnium tam nostri quam aliorum, præter globum istum unicum, annihilationem recte supposuerimus

"Concipiantur porro duo globi, et præterea nihil corporeum existere. Concipiantur deinde vires, quomodunque applicari: quidquid tandem per applicationem virium intelligamus, motus circularis duorum globorum circa commune centrum nequit per imaginationem concipi. Supponamus deinde cœlum fixarum creari: subito ex concepto appulsu globorum ad diversas cœli istius partes motus concipietur. Scilicet cum motus natura sua sit relativus, concipi non potuit priusquam darentur corpora correlata. Quemadmodum nec ulla relatio alia sine correlatis concipi potest." *De Motu.*

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vacuities in it sufficient to permit the motion of the planets and all the other heavenly bodies, which we plainly perceive to revolve round a centre; and if so, the next question to be determined is, What can *in vacuo* operate upon such immense bodies, so as to produce a regular and continued motion?

194 Bodies equally indifferent to motion and rest.

That all bodies are equally capable of motion or rest, has by natural philosophers been as completely proved as any thing can be proved by observation and experience. It is indeed a fact obvious to the most superficial observer; for if either of these states were essential to matter, the other would be absolutely impossible. If rest were essential, nothing could be moved; if motion were essential, nothing could be at rest, but every the minutest atom would have a motion of its own, which is contrary to universal experience. With respect to motion and rest, matter is wholly passive. No man ever perceived a body inanimated begin to move, or when in motion stop without resistance. A billiard ball laid at rest on the smoothest surface, would continue at rest to the end of time, unless moved by some force extrinsic to itself. If such a ball were struck by another ball, it would indeed be moved with a velocity proportioned to the impetus with which it was struck; but the impelling ball would lose as much of its own motion as was communicated to that upon which the impulse was made. It is evident, therefore, that in this instance there is no *beginning* of motion, but only the communication of motion from one body to another; and we may still ask, Where had the motion its origin? If the impelling ball was thrown from the hand of a man, or struck with a racket, it is plain that by a volition of the man's mind the motion was first given to his own arm, whence it proceeded through the racket from one ball to another; so that the ball, racket, and arm, were mere instruments, and the mind of the man the only agent or first mover. That motion can be *begun* by any being which is not possessed of life, consciousness, and will, or what is analogous to these, is to us altogether inconceivable. Mere matter or inanimated body can operate upon body only by impulse: but impulse, though from the poverty of language we are sometimes obliged to talk of its agency, is itself merely an effect; for it is nothing more than the contact of two bodies, of which one at least is in motion. An infinite series of effects without a cause is the grossest absurdity; and therefore motion cannot have been communicated from eternity by the impulse of body upon body, but must have been originally produced by a being who acts in a manner analogous to the energies of the human will.

195 Motion produced by impulse can only be in a straight line.

But though motion could not have been begun but by the energy of mind, it is generally believed that it might be continued by the mere passivity of body; and it is a law of the Newtonian philosophy, that a body projected in empty space would continue to move in a straight line for ever. The only reason which can be assigned for this law is, that since body continues to move at all after the impetus of projection has ceased, it could not of itself cease to move without becoming active; because as much force is required to stop a body in motion as to communicate motion to the same body at rest. Many objections have been made to this argument, and to the law of which it is the foundation; but as we do not perceive their strength, we shall not fill our page with a formal examination of them (R). If a single body could exist and have motion communicated to it *in vacuo* by the force of projection, we are persuaded, that from the very passivity of matter, that motion would never have an end; but it is obvious that it could be moved only in a straight line, for an impulse can be given in no other direction.

196 The Newtonian doctrine respecting the causes of the motion of the heavenly bodies.

The heavenly bodies, however, are not moved in straight lines, but in curves round a centre; and therefore their motion cannot have been originally communicated merely by an impressed force of projection. This is admitted by all philosophers, and therefore the Newtonians suppose that the planets are moved in elliptical orbits by the joint agency of two forces acting in different directions. One of these forces makes the planet tend directly to the centre about which it revolves; the other impels it to fly off in a tangent to the curve described. The former they call *gravitation*, which some of them have affirmed to be a property inherent in all matter; and the latter, which is a projectile force, they consider as impressed *ab extra*. By the joint agency of such forces, duly proportioned to each other, Sir Isaac Newton has demonstrated, that the planets must necessarily describe such orbits as by observation and experience they are found actually to describe. But the question with the metaphysician is, Whether such forces be real?

197 Mutual attraction among the heavenly bodies impossible.

With respect to projection, there is no difficulty; but that bodies should mutually act upon each other at a distance, and through an immense vacuum, seems at first sight altogether impossible. If the planets are moved by the forces of gravitation and projection, they must necessary move *in vacuo*; for the continual

(R) By much the strongest and best urged of these objections which we have seen, is made by Dr Horsley, a man equally learned in mathematics and in ancient and modern philosophy. "I believe with the author of Ancient Metaphysics (says he), that some active principle is necessary for the continuance as well as for the beginning of motion. I know that many Newtonians will not allow this: I believe they are misled, as I myself have formerly been misled by the expression *a state of motion*. Motion is a change; a continuance of motion is a farther change; a farther change is a repeated effect; a repeated effect requires a repeating cause. State implies the contrary of change; and motion being change, a *state of motion* is a contradiction in terms." See *Ancient Metaphysics*, Vol. II.

If our readers think this reasoning conclusive, they may be in the right; and in that case they will see the necessity of admitting, even for the continuance of rectilineal motion, the *plastic nature*, or something equivalent to it, without which we have endeavoured to prove that the heavenly bodies could not revolve round their respective centres in elliptical curves.

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resistance of even the rarest medium would in time overcome the force of the greatest impetus: but if they move *in vacuo*, how can they be attracted by the sun or by one another? It is a self-evident truth, that nothing can act but where it is present, either immediately or mediately; because every thing which operates upon another, must perform that operation either by its own immediate agency or by means of some instrument. The sun and planets are not in contact; nor, if the motion of these bodies be *in vacuo*, can any thing material pass as an instrument from the one to the other. We know indeed by experience, that every particle of unorganised matter within our reach has a tendency to move towards the centre of the earth; and we are intuitively certain, that such a tendency must have some cause: but when we infer that cause to be a power of attraction inherent in all matter, which mutually acts upon bodies at a distance, drawing them towards each other, we talk a language which is perfectly unintelligible (s). Nay more, we may venture to affirm that such an inference is contrary to fact. The particles of every elastic fluid fly *from* each other; the flame of a fire darts *upwards* with a velocity for which the weight of the circumambient air cannot account; and the motion of the particles of a plant when growing, is so far from tending toward the *centre* of the earth, that when a flowerpot is inverted, every vegetable in it, as soon as it is arrived at a sufficient length, bends itself over the side of the pot, and grows with its top in the natural position.

198 The heavenly bodies cannot be moved by two forces impressed ab extra;

Sensible of the force of these arguments against the possibility of an attractive power in matter which operates at a distance, other philosophers have supposed that the heavenly bodies are moved in elliptical orbits by means of two forces originally impressed upon each planet impelling it in different directions at the same time. But if the tendency of the planets towards the centre of the sun be of the same kind with that of heavy bodies towards the centre of the earth (and if there be such a tendency at all, we have no reason to suppose it different), it cannot possibly be the effect of impulse. A body impelled or projected *in vacuo* would continue to be moved with an equable velocity, neither accelerated nor retarded as it approached the object towards which it was directed; but the velocity of a body tending towards the centre of the earth is continually accelerated: and as we cannot doubt but that the same thing takes place in the motion of a body tending towards the centre of the sun, that motion cannot be the effect of impulse or projection.

199 Nor by the agency of any material fluid.

Some of the Newtonians therefore have supposed, "That all kinds of attraction consist in fine imperceptible particles or invisible effluvia, which proceed from every point in the surface of the attracting body, in all right-lined directions every way; which in their progress lighting on other bodies, urge and solicit them towards the superior attracting body; and therefore (say they) the force or intensity of the attracting power in general must always decrease as the squares of the distances increase." The inference is fairly drawn from the fact, provided the fact itself were real or possible: but it is obvious, that if fine imperceptible particles or invisible effluvia were thus issued from every point in the surface of the sun, the earth and other planets could not move *in vacuo*; and therefore the projectile motion would in time be stopped by the resistance

(s) Since this article was finished for the press, Professor Stewart's *Elements of the Philosophy of the Human Mind* have been given to the public; a work of which the merit is such as to make it painful to us to differ in any important opinion from the ingenious author. We shall, however, claim the same liberty of dissenting occasionally from him that he has claimed of dissenting from Newton, Locke, Clarke, and Cudworth, from whom he differs widely in thinking it as easy to conceive how bodies can act upon each other at a distance, as how one body can communicate motion to another by impulse. "I allow (says he, p. 79), that it is impossible to conceive in what manner one body acts upon another at a distance through a vacuum; but I cannot admit that it removes the difficulty to suppose, that the two bodies are in actual contact. That one body may be the efficient cause of the motion of another body placed at a distance from it, I do by no means assert; but only that we have as good reason to believe that this may be possible, as to believe that any one natural event is the efficient cause of another."

If by *efficient* cause be here meant the *first* and *original* cause of motion, we have the honour to agree with the learned Professor; for we are persuaded that body inanimated is not, in this sense of the word, the cause of motion either at hand or at a distance: but if he mean (and we think he must, because such was the meaning of Newton, from whom he professes to differ), that we can as easily conceive one body to be the instrumental cause of the motion of another from which it is distant, as we can conceive it to communicate motion by impulse, we cannot help thinking him greatly mistaken. We will not indeed affirm, with the writer whom he quotes, "that although the experiment had never been made, the communication of motion by impulse might have been predicted by reasoning *à priori*;" because we are not certain, that without some such experiment we should ever have acquired adequate notions of the solidity of matter: But if all corporeal substances be allowed to be solid and possessed of that negative power to which philosophers have given the name of *vis inertiæ*, we think it may be easily proved *à priori*, that a sufficient impulse of one hard body upon another *must* communicate *motion* to that other; for when the *vis inertiæ*, by which alone the one body is kept in its place, is less than the *vis impetus* with which the other rushes to take possession of that place, it is evident that the former body *must* give way to the latter, which it can do only by motion, otherwise the two bodies would occupy one and the same place, which is inconsistent with their solidity. But that a substance possessed of a *vis inertiæ* should make another substance possessed of the same negative power quit a place to which itself has no *tendency*, is to us not only *inconceivable*, but apparently impossible, as implying a direct contradiction.

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ance of this powerful medium. Besides, is it not altogether inconceivable, nay impossible, that particles issuing *from* the sun should draw the planets *towards* that centre? would they not rather of necessity drive them to a greater distance? To say, that after they have reached the planets, they change their motion and return to the place whence they set out, is to endue them with the powers of intelligence and will, and to transform them from passive matter to active mind.

These difficulties in the theories of attraction and impulse have set philosophers upon fabricating numberless hypotheses: and Sir Isaac Newton himself, who never considered gravitation as any thing more than an effect, conjectured that there might be a very subtle fluid or ether pervading all bodies, and producing not only the motion of the planets, and the fall of heavy bodies to the earth, but even the mechanical part of muscular motion and sensation. Others (T) again have supposed fire, or light, or the electric fluid, to be the universal agent; and some few (U) have acknowledged, that nothing is sufficient to produce the phenomena but the immediate agency of mind.

With respect to the interposition of any material fluid, whether ether, fire, light, or electricity, it is sufficient to say that it does not remove any one difficulty which encumbers the theory of innate attraction. All these fluids are elastic; and of course the particles of which they are composed are distant from each other. Whatever motion, therefore, we may suppose to be given to one particle or set of particles, the question still recurs. How is it communicated from them to others? If one body can act upon another at the distance of the ten-thousandth part of an inch, we can perceive nothing to hinder its action from extending to the distance of ten thousand millions of miles. In the one case as well as the other, the body is acting where it is not present; and if that be admitted to be possible, all our notions of action are subverted, and it is vain to reason about the cause of any phenomenon in nature.

200 The hypothesis of Plato, Aristotle, and Cudworth,

This theory of the intermediate agency of a subtle fluid differs not essentially from the vortices of Des Cartes; which appeared so very absurd to Cudworth, that with a boldness becoming a man of the first genius and learning, he rejected it, and adopted the plastic nature of Plato, Aristotle, and other Greek philosophers. That incomparable scholar observes, that matter being purely passive, the motion of the heavenly bodies, the growth of vegetables, and even the formation of animal bodies, must be the effect either of the immediate agency of God, or the agency of a *plastic nature* used as an instrument by divine wisdom. That they are not the effects of God's immediate agency he thinks obvious from several circumstances. In the first place, they are performed slowly and by degrees, which is not suitable to our notions of the agency of almighty Power. Secondly, Many blunders are committed in the operations of nature, such as the formation of monsters, &c. which could never be were things formed by the immediate hand of God. He is therefore of opinion, that, after the creation of matter, God employed an inferior agent to give it motion and form, and to carry on all those operations which have been continued in it since the beginning of the world. This agent he calls *plastic nature*; and considers it as a being incorporeal, which penetrates the most solid substance, and, in a manner which he pretends not to explain otherwise than by analogy, actuates the universe. He does not look upon it as a being endued with perception, consciousness, or intelligence; but merely as an instrument which acts under divine wisdom according to certain laws. He compares it to art embodied; and quoting from Aristotle, says, Ει ενην τω ξυλω ἡ ναυπηγικη ὁμοιως αν τη φυσει εποιει. *If the art of the shipwright were in the timber itself, operatively and effectually, it would there act just as nature doth.* He calls it a certain lower life than the animal, which acts regularly and artificially for ends of which it knows nothing. It may be, he says, either a lower faculty of some conscious soul, or else an inferior kind of life or soul by itself, but depending in either case upon a higher intellect. He is aware with what difficulty such a principle will be admitted by those philosophers who have divided all being into such as is extended and such as is cogitative: but he thinks this division improper. He would divide beings into those which are solid and extended, and those which have life or internal energy. Those beings which have life or internal energy he would again divide into such as act with consciousness, and such as act without it: the latter of which is this plastic life of nature. To prove that such an instrument is possible, or that a being may be capable of operating for ends of which it knows nothing, he instances *bees* and other animals, who are impelled by *instinct* to do many things necessary to their own preservation, without having the least notion of the purpose for which they work. (See INSTINCT.) He observes, that there is an essential difference between reason and instinct, though they are both the attributes of mind or incorporeal substance: and that therefore, as we know of two kinds of mind differing so widely, there is nothing to hinder us from inferring a third, with powers differing as much from instinct as instinct differs from reason. Mankind are *conscious* of their own operations, *know* for what *purpose* they generally act, and can by the power of *reflection* take a *retrospective* view of their actions and thoughts, making as it were the mind its own object. Brutes are *conscious* of their own operations, but they are ignorant of the *purposes* for which they operate, and altogether *incapable* of *reflecting* either upon their past conduct or past thoughts. Between their intellectual powers and those of man, there is a much greater difference than there is between them and a plastic nature, which acts as an instrument of divine wisdom without any consciousness of its own operations. Aristotle, from whom principally the

(T) The several followers of Mr Hutchinson.
(U) Cudworth, Berkeley, and the author of Ancient Metaphysics.

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the learned author takes his notion of this plastic nature, compares it, with respect to the divine Wisdom which directs and superintends its operations, to a mere builder or mechanic working under an architect, for the purpose of which the mechanic himself knows nothing. The words of the Stagyrite are: Τους αρχιτεκτονας περι εκαστον τιμιωτερους και μαλλον ειδεναι νομιζομεν των χειροτεχνων, και σοφωτερους ὁτι τας αιτιας των ποιουμενων ισασιν οἱ δ' ὡσπερ και των αψυχων ενια, ποιει μεν, ουκ ειδοτα δε ποιει, οἱον καιει το πυρ' τα μεν ουν αψυχα φυσει τινι ποιειν τουτων ἑκαστον τους δε χειροτεχνας διεθος*. "We account the architects in every thing more honourable than the mere workmen, because they understand the reason of the things done; whereas the other, as some inanimate things, only work, not knowing what they do, just as the fire burns: the difference between them being only this, that inanimate things act by a certain nature in them, but the workman by habit."

* Metaphy. Lib. i. chap. 1.

201 Shown to be possible.

Still further to prove that a being may be endowed with some vital energy of a subordinate kind, and yet be destitute of consciousness and perception, the learned author observes, that there is no reason to think that the souls of men in sound sleep, lethargies, or apoplexies, are conscious of any thing; and still less, if possible, to suppose that the souls of embryos in the womb are from the very first moment of their arrival there intelligent and conscious beings: neither can we say, how we come to be so differently affected in our souls by the different motions made upon our bodies, nor are we conscious always of those energies by which we impress fantastic ideas on the imagination. But if it be possible for the souls of men to be for one instant void of consciousness and intelligence, it follows, that consciousness is not absolutely necessary to those energies and motions by which life is preserved. To this it may be added, upon the best authority‡, "that where animal or vegetable life is concerned, there is in every case a different relation between the cause and effect, and seemingly depending upon the concurrence or influence of some farther principle of change in the subject, than what subsists in inanimate matter, or in the causes and effects that are the objects of mechanical and chemical philosophy." Now to this principle of vegetable life, without which, in a seed or in a plant, vegetation will neither begin nor continue, though light, heat, air, earth, and water, should concur in the utmost perfection. Cudworth expressly compares his plastic nature in the universe. It is so far (says he) from being the first or highest life, that it is indeed the last and lowest of all lives, being really the same thing with the vegetative.

‡ Gregory's Philosophical and Literary Essays.

202 Arguments for its truth: but

These arguments, if the phenomena of elective attractions in chemistry be added to them, demonstrate, we think, the *possibility* of such a principle; and to those who are inclined to affirm that no such thing can exist, because, according to the description of it given by Cudworth and the ancients, it is neither body nor spirit, in the proper sense of the words; we beg leave to ask in the words of Locke, "Who told them that there is and can be nothing but solid beings which cannot think, and thinking beings that are not extended? which is all that they mean by the terms body and spirit." All the Greek philosophers who were not materialists, and even the inspired writers of the Old and New Testaments, constantly distinguish between the *spirit* and the *soul*, of a man calling the former sometimes νους and sometimes πνευμα, and the latter ψυχη; and St Paul, who before he was a Christian was learned in philosophy, describes the constituent parts of man as three, πνευμα, ψυχη, σωμα, *spirit*, *soul*, and *body*. This distinction, setting aside the *authority*, with which it comes to us, seems to be well founded; for there are many operations carried on in the human body without any conscious exertion of ours, and which yet cannot be accounted for by the laws of mechanism. Of these, Cudworth instances the motion of the diaphragm and other muscles which causes respiration, and the systole and diastole of the heart: neither of which, he thinks, can be the effect of mere mechanism. But, as we are not conscious of any energy of soul from which they proceed, even while we are awake, and still less, if possible, while we are asleep; he attributes them, not to the intellect or rational mind, but to this inferior vital principle called ψυχη (v); which, in his opinion, acts the

(v) The existence of this plastic nature was warmly debated between Monsieur Le Clerc and Monsieur Bayle. Mosheim, who was inclined himself to admit such a principle, gives the following view of Le Clerc's sentiments from *Bibliotheque choisie*, tom. ii. p. 113. "Respiratio inquit, et motus cordis, actiones sunt, quorum nihil ad animam pertinet. Interim mechanice eas fieri, nullo modo probabile est. In voluntariis commotionibus nesciunt animi nostri, quid facto opus sit, ut membra commoveantur: imperant illi tantum. Est vero aliud nescio quid, quod fideliter, si modo organa recte sint affecta, mandata ejus exsequitur. Quidni igitur suspicemur, esse *naturam* in corpore nostro *viventem*, præter animam nostram, cujus sit animæ præceptis et jussis morem gerere? quamquam potentia ejus ita sit definita, ut obedire nequeat animo, nisi recte sese habeant organa. Eadem forte natura, corporis nostri motibus impulsa, animam edocet, quid factum sit, ut ille possit præcipere, quæ ad conservationem corporis necessaria judicat. Anima, pergit, si hæc vera esse putes, similis erit domino, sibimet ipsi servire nescio, nec ulla facultate alia, quam imperandi et jubendi instructo. Hæc vero natura fictrix non dissimilis erit mancipii cui nihil eorum, quæ dominus meditatur, notum est, quodque nihil aliud facit, quam ut jussis pareat, et dominum de illis rebus admoneat, quæ ad salutem ipsius pertinent." Mosheim proceeds,—Si quis huic loco sic occurrat, Hæc ratione tria fingi in homine principia; respondet vir doctus; "Nullis constaris argumentis, binis tantum hominem partibus constare. Eos, qui hominem ex binis tantum partibus component, nulla ratione explicare posse naturam conjunctionis animi et corporis, nisi ipsum Deum statuant cunctis actionibus hominum intervenire: hoc vero Divina Majestate prorsus indignum esse. Definitionem accuratam mediæ hujus naturæ postulantibus sese talem dare non posse definitionem respondet: Hoc unum sese scire: esse eam naturam interiori agendi virtute instructam, quæ ex se et animam et corpus afficere queat: naturam, quæ doceat animam quid rerum

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the same part in the system of the human body which the plastic nature acts in the system of the world.—To make the resemblance more striking, he observes, that even the voluntary motion of our limbs, though it proceeds ultimately from an energy of will, seems to be the effect of that energy employing some *instrument* which pervades the sinews, nerves, and muscles of the body; and if the human spirit or πνευμα employ the instrumentality of a plastic nature or ψυχη in moving the small machine of the body, it seems to be far from incredible that the Divine Wisdom should employ the instrumentality of a plastic nature in moving the great machine of the universe.

203 Whether it be true or not, the motions of the heavenly bodies are carried on by the constant agency of something incorporeal.

But we need not insist further on the *possibility* of such an instrument. Whatever may be thought of the arguments of Cudworth, of which some are, to say the least of them, plausible, though others appear to us to have very little strength, Dr Clarke has proved, with a force of reasoning not inferior to mathematical demonstration, that the motions of the heavenly bodies are carried on by the agency of something very different from matter, under every possible form. "For not to say that, seeing matter is utterly incapable of obeying any *laws* in the proper sense of the word, the very original laws of motion themselves cannot continue to take place, but by something superior to matter, *continually* exerting on it a certain force or power according to such certain and determinate laws; it is now evident beyond question, that the bodies of all *plants* and *animals* could not possibly have been formed by mere matter according to any general laws of motion. And not only so, but that most universal principle of *gravitation* itself, the spring of almost all the great and regular inanimate motions in the world, answering not at all the *surfaces* of bodies, by which alone they can act upon one another, but entirely to their *solid contents*, cannot possibly be the result of any motion originally impressed upon matter." For though it is true, that the most solid bodies with which we are acquainted are all very porous; and that, therefore, a subtle material fluid might penetrate the bodies of the planets, and operate upon them with a force exerted internally; still it is self-evident, that the *greatest* quantities of such a fluid could not enter into those bodies which are *least* porous, and where the greatest force of *gravitation* resides: "and, therefore, this motion must of necessity be caused by something which penetrates the very *solid substance* of all bodies, and continually puts forth in them a force or power entirely different from that by which matter acts upon matter †." Which is, as the same able writer observes, an evident demonstration, not only of the world's being originally made by a supreme intelligent Cause; but moreover that it depends every moment upon some superior Being, for the preservation of its frame; and that all the great motions in it are caused by some immaterial power *perpetually* and *actually* exerting itself every moment in every part of the corporeal universe. This preserving and governing power, whether it be the immediate power and action of the same Supreme Cause that created the world, or the action of some subordinate instruments appointed by him to direct and preside respectively over certain parts thereof, gives us equally in either way a very noble idea of Providence. We know with certainty, that *real* and *original power* can belong only to a being endowed with intelligence and will; and, therefore, if the existence of Cudworth's (w) plastic nature be

† Evidence of Nat. and Revealed Religion.

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rerum geratur in corpore; naturam denique, quæ animi mandatis, quorum tamen caussas nesciat, fideliter obtemperet." Reliqua, quæ illustrandæ hujus rei caussa Clericus affert, prætereo. Satis copiosa est in illis, quæ produximus, meditandi materia. *Mosheim. ed. Syst. Intellect.* p. 173.

Such a principle actuating the universe, if it be divested of intelligence, and considered as a second or inferior cause, under the direction of the Supreme, is acknowledged by a very able judge to be a rational hypothesis; and such, if properly pursued, would certainly open a most entertaining scene of natural philosophy. See *Jones's Answer to an Essay on Spirit.*

(w) Besides Cudworth, we have mentioned Berkeley and the author of *Ancient Metaphysics*, as holding all motion to be an effect of the immediate agency of mind or incorporeal substance. The opinion of the last of these philosophers is not essentially different from Cudworth's; and therefore it is needless to quote from him: Berkeley was better acquainted with the principles of the Newtonian philosophy, as well as an abler mathematician, than either of these pupils of the ancients; and being likewise a man who on all subjects thought for himself, it may be worth while to lay before our rerders a short abstract of his reasoning respecting the origin of motion. His words are: "Totum id quod novimus, cui nomen *corpus* indidimus, nihil in se continet quod motus principium seu causa efficiens esse possit. *Vis*, *gravitas*, *attractio*, et hujusmodi voces, utiles sunt ad ratiocinia et computationes de motu et corporibus motis; sed non ad intelligendam simplicem ipsius motus naturam, vel ad qualitates totidem distinctas designandas. Attractionem certe quod attinet, patet illam ab Newtono adhiberi, non tanquam qualitatem veram et physicam, sed solummodo ut hypothesin mathematicam. Quin et Leibnitius, nisum elementarem seu solicitationem ab impetu distinguens, fatetur illa entia non re ipsa inveniri in rerum natura, sed abstractione facienda esse. Similis ratio est compositionis et resolutionis virium quarumcunque directarum in quascunque obliquas, per diagonalem et latere parallelogrammi. Hæc mechanices et computationi inserviunt: sed aliud est computationi et demonstrationibus mathematicis inservire, aliud rerum naturam exhibere. Revera corpus æque perseverat in utrovis statu, vel motus vel quietis. Ista vero perseverantia non magis dicenda est actio corporis, quam existentia ejusdem actio diceretur. Cæterum resistentiam, quam experimur in sistendo corpore moto, ejus actionem esse fingimus vana specie delusi. Revera enim ista resistentia quam sentimus, passio est in nobis, neque arguit corpus agere, sed nos pati: constat utique nos idem passuros fuisse, sive corpus illud a se moveatur, sive ab alio principio impellatur.—Actio et reactio dicuntur esse in corporibus: nec incommode ad demonstrationes mechanicas. Sed cavendum, ne propterea suppo-

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be admitted, (and we see not (x) why it should be called in question), it can be considered only as an instrument employed by Divine Wisdom, as a chizzel or a saw is employed by the wisdom of the mechanic.

204 This theory not inconsistent with the principle of Newton.

Nor let it be imagined, that this ancient theory of motion is in any degree inconsistent with the mathematical principles of Sir Isaac Newton's astronomy, or with the calculations, raised from those principles. Having founded his astronomy on analogy between the phænomena of projectile and planetary motions, he assigned the same or similar *forces* existing in nature as the efficient causes of both. And indeed, both in the act of deriving his *principles* from the projectile phenomena, and afterwards for the purpose of applying them to the planetary, it was necessary to analyze the elliptical motion of the heavenly bodies into a compound of two simple motions in right lines, produced by the action of these different forces; and this might also be useful for the purposes of teaching and demonstration, just as we find it necessary, in all parts of science, to separate what in nature is inseparable, for the convenience and assistance of the understanding. The planetary motions, however, are very probably simple and uncompounded, for no experiments can be tried in those distant regions; and the astronomy of Newton, which is only the application of his mathematical principles to their mensuration from their *analogy* to projectile motions, does not at all require that the forces of gravitation and projection be assigned as their real existent causes (y). It is sufficient for the *analogy*, on which the whole philosophy is founded, that the phenomena of motion are known from experiments and observations to be the *same* in *both* instances; that the *principles* or *general laws* mathematically established from the *forces* of the *one* are transferred to the *phenomena* of the *other*; and that the proofs and operations deduced from these principles in the latter case, are confirmed by *facts* and *experience*, the first and final test of truth. *

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* Tatham's Chart and Scale of Truth.

Chap. VI. *Of* Number.

205 Unity, as an idea, cannot

"Amongst all the ideas that we have, as there is none (says Mr Locke ‡) suggested to the mind by more ways, so there is none more simple than that of unity or one. It has no shadow of variety or composition in it. Every object our senses are employed about, every idea in our understandings, every thought of our minds, brings this idea along with it: and there-

‡ Essay, Book ii, chap. 16.

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supponamus virtutem aliquam realem, quæ motus causa sive principium sit, esse in iis. Etenim voces illæ eodem modo intelligendæ sunt ac vox *attractio*: et quemadmodum hæc est hypothesis solummodo mathematica, non autem qualitas physica; idem etiam de illis intelligi debet, et ob eandem rationem.

"Auferantur ex idea corporis extensio, soliditas, figura, remanebit nihil. Sed qualitates istæ sunt ad motum indifferentes, nec in se quidquam habent, quod motus principium dici possit. Hoc ex ipsis ideis nostris perspicuum est. Si igitur voce *corpus* significatur id quod concipimus, plane constat inde non peti posse principium motus: pars scilicet nulla aut attributum illus causa efficiens vera est, quæ motum producat. Vocem autem proferre, et nihil concipere, id demum indignum esset philosopho.

"Præter res corporeas, alterum est genus rerum cogitantium: in iis autem potentiam inesse corpora movendi, propria experientia didicimus, quando quidem anima nostra pro lubitu possit ciere et sistere membrorum motus, quacunque tandem ratione id fiat. Hoc certe constat, corpora moveri ad nutum animæ, eamque proinde haud inepte dici posse principium motus; particulare quidem et subordinatum, quodque ipsum dependeat, a primo et universali principio.

"Ex dictis manifestum est eos qui vim activam, actionem, motus principium, in corporibus revera inesse affirmant, sententiam nulla experientia fundatam amplecti, eamque terminis obscuris et generalibus adstruere, nec quid sibi velint satis intelligere. E contrario, qui mentem esse principium motus volunt, sententiam propria experientia munitam preferunt, hominumque omni ævo doctissimorum suffragiis comprobatam.

"Primus Anaxagoras τον νουν introduxit, qui motum inerti materiæ imprimeret: quam quidem sententiam probat etiam Aristoteles, pluribusque confirmat, aperte pronuncians primum movens esse immobile, indivisibile, et nullum habens magnitudinem. Dicere autem, omne motivum esse mobile, recte animadvertit idem esse ac siquis diceret, omne ædificativum esse ædificabile. Plato insuper in Timæo tradit machinam hanc corpoream, seu mundum visibilem, agitari et animari a mente, quæ sensum omnem fugiat. Et Newtonus passim nec obscure innuit, non solummodo motum ab initio a numine profectum esse, verum adhuc systema mundanum ab eodem actu moveri. Hoc sacris literis consonum est: hoc scholasticorum calculo comprobatur."

De Motu, passim.

(x) This we say upon the received opinion, that there are beings wholly incorporeal. The truth of the opinion itself will be considered in a subsequent chapter.

(y) Indeed Sir Isaac himself is very far from positively assigning them as the *real* causes of phenomena. The purpose for which they were introduced into his philosophy he clearly explains in the following words; "Eadem ratione qua projectile vi gravitatis in orbem flecti posset et terram totam circumire, potest et luna, vel vi gravitatis, *si modo gravis sit*, vel alia quacunque vi qua in terram urgeatur, retrahi semper a cursu rectilineo terram versus et in orbem suum flecti: et absque tali vi luna in orbe suo retineri non potest. Hæc vis, si *justo minor* esset, non satis flecteret lunam a cursu rectilineo: si *justo major*, plus satis flecteret, ac de orbe terram versus deduceret. Requiritur quippe ut sit *justæ magnitudinis*: et mathematicorum est invenire vim, qua corpus in dato quovis orbe data cum velocitate accurate retineri possit; et vicissim invenire viam curvilineam, in quam corpus e dato quovis loco data cum velocitate egressum data vi flectatur."——*Principia Mathem.* Def. V.

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therefore it is the most intimate to our thoughts, as well as it is, in its agreement to all other things, the most universal idea we have; or number applies itself to men, angels, actions, thoughts, every thing that either doth exist or can be imagined. "He seems likewise to be of opinion that we have the idea of *unity* before that of *many;* and that it is by repeating the simple idea of unity in our own minds that we come by the *complex ideas* of *two, three*, &c." In this opinion he is joined by Pere Buffier * ; who observes that it is impossible to explain the nature of *unity*, because it is the most simple idea, and that which perhaps *first* occurred to the mind.

* First Truths.

That *unity* is a simple idea, must be granted; but it certainly did not first occur to the mind, nor can it be abstracted from all individuals, and apprehended in Locke's sense of the word as a *general idea*. Let any man look into his own mind, and then say whether he has a general idea of *one* or *unity* as abstracted from every individual object mental and corporeal. In particular, when he thinks he has completely abstracted it from body and mind, sensations, ideas, actions, and passions, &c. let him be sure, before he pronounce it a general *abstract* idea, that he is not all the while contemplating the idea of its *name*, or of that numerical *figure* by which it is marked in the operations of arithmetic. Both these ideas are in themselves particular; and become general in their import, only as representing every individual object to which unity is in any sense applicable. But in the chapter *of abstraction*, we have said enough to convince every person capable of conviction that they are used as signs for whole classes of objects.

206 be abstracted from every individual.

Instead of being an abstract general idea, *unity*, as the basis of number, is in fact nothing but a mere *relation*, which cannot be conceived without the related objects; and so far is it from being the *first* idea that occurred to the mind, that it is certainly the result of a comparison, made by the intellect, of two or more objects The ideas which first occur to the mind are, beyond all doubt, those which are called *ideas of sensation;* and many such ideas every child receives before he is capable of comparing objects and forming to himself notions of number. *Unity*, or the idea of *one*, is indeed the element of the science of *arithmetic*, just as a mathematical *point* is the element of the science of *geometry;* but accurate notions of these elements are, in the progress of knowledge, subsequent to ideas of *many* and of *surfaces*. There is reason to believe that persons totally illiterate have no notion at all of *mathematical points;* and we think it possible to conceive an intelligent and conscious being in such a situation as that he could not acquire a notion of *unity* or *one*. Were a child never to see or feel two objects of the *same kind*, we doubt if he would think of numbering them, or of making such a comparison of the one with the other as would suggest to his mind the relations of *one* and *two;* for these relations imply both a sameness and a difference of the objects beyond the power of a child to ascertain. The difference indeed would be perceptible to the senses, but the senses would perceive no sameness or agreement. A guinea, a shilling, and a ball of lead, impress upon the mind different sensations; and therefore a child undoubtedly distinguishes these objects from one another: but what could make him derive from them his first idea of the relation of number? A guinea, a shilling, and a ball of lead, are not *one, two, three*, in any sense which a child can comprehend. To be convinced of this, let any man throw a guinea, a shilling, and a ball of lead upon a table, and ask a *clown* what is their number. From being accustomed to retail the *names* of number as signs, without affixing to them any idea of the things signified, he will probably answer with quickness *three*, or perhaps *one, two, three:* but if he be further asked in what *respect* they are *one, two, three*, we believe his answer will not be so ready: They are not *one, two, three guineas*, or *shillings*, or *balls of lead*. A philosopher knows them to be three pieces of the same first matter under different forms, and can therefore apply to them the relation of number with truth and propriety; but of the first matter a *clown* is entirely ignorant, and of course cannot call them *one, two, three*, in any sense which is at once true and to him intelligible.

207 Unity, a particular relation.

To make it still more evident, that it is only by comparing together things of the *same kind* that our *first* ideas of unity and number are formed, let us suppose no created being to have hitherto existed except the animated and intelligent globe mentioned in the last chapter, and we think it will be granted that such a being in solitude could never acquire the idea of *unity*. Let us next suppose a *cubical* body to be created and exhibited to the senses of this spherical man; the consequence would be a *sensation* or feeling entirely new: but that feeling would not be of *unity*; for, as the author of *Ancient Metaphysics* has somewhere well observed, unity is no object of sensation. The sensation would be of colour, hardness, softness, roughness or smoothness, &c. for beyond these the empire of the senses does not reach. Again, let another body be created of a colour and figure totally different from the colour and figure of the cube, and the spherical man would then experience new sensations having no agreement with those which he had formerly felt. These different kinds of sensations might be compared together; but the result of the comparison would not be the ideas which are denoted by the words *one* and *two*, but merely that which is expressed by *difference* or *dissimilarity*. Were another cube, however, of exactly the same size and colour with the former to be brought into existence, and both to be at once presented to the view of the spherical man, the rudiments of the idea of number would then be generated in his mind, because he could not but perceive the cubes to be in one respect different and in another the same; different as being distinct from each other, and agreeing in their effects upon the organs of sensation.

208 Men must have made some progress in classing things according to genera and species, before they acquired any notion of number.

It appears, therefore, that mankind must have made some progress in classing things according to their genera and species, before they acquired any correct ideas of the relation of number, or thought of using numerical names or figures as general and discriminating signs: for we say *one, two, three*, &c. only with respect to the species or genus of which each of the things denoted by these numbers is an individual; and if there be any thing which has no genus or species, neither number nor unity can, in the original sense of the

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the words, be predicated of it (z). We ſay indeed that there is *one* God, but perhaps we do not always attend to the meaning of the expreſſion. Language was formed to anſwer the common purpoſes of life; and thoſe purpoſes are beſt anſwered by denoting individuals by the name of the ſpecies or genus to which they belong: but *God* belongs to no ſpecies or genus, unleſs he be ſaid improperly (A) to be of the univerſal genus of *Being*; and therefore the true meaning of the word *one*, when joined to the verb *is*, and transferred from the creature to the Creator, in ſuch a ſentence as—"there *is one* God"—ſeems to be nothing more than an affirmation that God exiſts, and that to him the relation of number cannot be applied. In a word, *unity* and *number* are merely relations between the individuals of the ſame ſpecies or genus of being; and men acquire ideas of theſe relations at the ſame time and by the ſame means that they are led to claſs things into ſpecies and genera. As to the proceſſes of addition and ſubtraction, and the various purpoſes to which number is applied, theſe things belong to the ſcience of arithmetic, and fall not under the province of the metaphyſician, whoſe ſole object is to aſcertain the real nature and cauſes of things. It may, however, be worth while to obſerve, that Locke, whoſe notions of number ſeem to have been different from ours, owns, that a man can hardly have any ideas of numbers of which his language does not furniſh him with names. But if units were either real things, or even poſitive ideas, we ſee not how *names* could be neceſſary to their exiſtence; whereas, if they be nothing more than mere relations, it is obvious that they cannot be conceived but as relative either to beings actually exiſting, or to names which are the ſigns of actual beings.

Chap. VII. *Of* Time.

209 Time, a mode of duration in contradiſtinction to eternity.

When St Auguſtine was aſked what time is? he replied, "*Si non roges, intelligo.*" An anſwer from which it may be inferred, that he thought the nature of *time* could not be explained by a logical definition. *Time* and *eternity* are commonly conſidered as the two modes of *duration*; and if duration be taken in what Locke thinks its true and original ſenſe, to denote permanence of exiſtence with a kind of reſiſtance to any deſtructive force, the diſtinction ſeems to be ſufficiently proper. It is indeed the beſt that we can make or comprehend; for *duration*, *time*, and *eternity*, are ſubjects which have perplexed philoſophical minds in all ages, and of which if we have adequate notions, it is very difficult to expreſs theſe notions in language. Inſtead of attempting it by previous definitions, the method in which the ancients generally began their inquiries, we ſhall purſue the better courſe of induction recommended by Lord Bacon, and endeavour to ſhow by what means we acquire the notion of that mode of duration which is called *time* in contradiſtinction to *eternity*. We begin with time; becauſe we ourſelves exiſt in it, and it is in ſome ſenſe familiar to us. If we be able to trace our notions of this mode of duration to their ſource, we may then give a definition of it founded on fact and univerſal experience, and afterwards proceed to conſider the other mode in conjunction with infinity, to which it is nearly allied.

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It has been already obſerved (ſee n° 93 of this article), that every man, while awake, has a train of ſenſations and ideas conſtantly paſſing through his mind, in ſuch a manner as that the one ſucceeds the other in a regular order. It is not poſſible, either, by detaining in the mind one idea to the excluſion of all others, to ſtop the courſe of this ſucceſſion entirely; or, by hurrying ſome ideas off the ſtage, and calling others in their place, to quicken its progreſs beyond a certain degree. One man indeed has naturally a quicker ſucceſſion of ideas than another; and all men can, by great exertions, accelerate or retard in a ſmall degree the natural flow of their thoughts. A ſtudious man lays hold, as it were, of a particular idea, which he wiſhes to contemplate, and detains it in the imagination, to the excluſion of all others; a man of wit calls remote ideas into view with a rapidity of which a cool and phlegmatic reaſoner can form no conception; and a forcible *ſenſation* takes full poſſeſſion of the mind, to the excluſion of all *ideas* whatever. Whilſt the attention is wholly occupied by one idea, or by one ſenſation, the mind has no notion whatever of time; and were it poſſible to detain ſuch idea or ſenſation alone in the mind till the hand of a clock ſhould move from the number of one hour to that of another, the hour, as marked on the dial-plate and meaſured by the motion of the hand, would appear but as one inſtant abſolutely void of duration. For the truth of this aſſertion we appeal to the experience of our readers. Such of them as have ever been engaged in deep ſtudy muſt often have had their attention

210 Whilſt the mind is occupied by one idea or notion, there is no perception of time; which

(z) We are happy to find our notions on this ſubject confirmed by an authority ſo reſpectable as that of Profeſſor Stewart. "Without the power of attending ſeparately to things which our ſenſes preſent to us in a ſtate of union, we never (ſays this able writer) could have had any idea of *number*: for before we can conſider different objects as forming a multitude, it is neceſſary that we ſhould be able to apply to all of them one common name; or, in other words, that we ſhould reduce them all to the ſame genus. The various objects, for example, animate and inanimate, which are at this moment before me, I may claſs and number in a variety of different ways, according to the view of them that I choose to take. I may reckon ſucceſſively the number of ſheep, of cows, of horſes, of elms, of oaks, of beeches; or I may firſt reckon the number of animals, and then the number of trees; or, I may at once reckon the number of all the organized ſubſtances which my ſenſes preſent to me. But whatever be the principle on which my claſſification proceeds, it is evident that the objects numbered together muſt be conſidered in thoſe reſpects only in which they agree with each other; and that if I had no power of ſeparating the combinations of ſenſe, I never could have conceived them as forming a plurality." *Elements of the Philoſophy of the Human Mind*, chap. iv.

(A) We ſay *improperly*, becauſe beings which were *created* can have nothing in *common* with that being which is *ſelf-exiſtent*, and upon whoſe *will* and *power* all other things depend.

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attention so fixed upon one object, that large portions of time, as measured by the clock, have passed away wholly unheeded; and every man who has seen a very striking and uncommon object, must remember, that when the sensation was first impressed upon his mind, all other objects, ideas, and notions, and among the rest the notion of time, were for a while excluded.

No sensation, however, keeps possession of the whole mind after it has ceased to be new; nor can the most vigorous exertions long preserve any one idea from being driven off the stage by the succeeding train. Now this succession of ideas appearing and disappearing in their turns, is that which, when compared with the permanency of ourselves and other things, gives us our first and justest notion of time: for whilst we are thinking, or whilst a series of ideas is successively passing through our minds and vanishing, we know that we ourselves and the things around us exist; and this existence, or continuation of existence, commensurate with the train of our fleeting ideas, is what we call the *duration* of ourselves and the things around us.

211 arises from comparing the succession of our ideas with the permanence of ther objects.

We are aware that our first notions of time have been often said to be derived from *motion* as perceived by our senses in the objects around us. It is observed by Euclid, that "if there were no *motion*, there could be no sound, nor any sense of hearing." "He might have added, (says the author of Ancient Metaphysics), nor any other perception of sense. Further, without motion there would have been no visible world, nor generation or production of any kind here below; and, among other things, *time* could have had no existence." All this is certainly true; but that corporeal motion, though the original source of all our ideas, is not that which *immediately* suggests to us the notion of time, will be readily granted by him who considers that motion itself is perceived by us only when it excites or accompanies a constant succession of perceptions and ideas. Motion, when equable and very slow, such as that of the hour-hand of a common watch, is not perceived by us in its course; nor can we discover that the thing has moved at all, till after we have been sensible of the lapse of a considerable portion of what is commonly called *time*; when we discover that the hand of the watch has changed its place with respect to other objects which we know to be fixed. The same is true of motion remarkably quick: "Let a cannon-ball (says Locke) pass through a room, and in its way take with it any limb or fleshy parts of a man; it is as clear as any demonstration can be, that it must strike successively the two sides of the room: it is also evident that it must touch one part of the flesh first, and another after, and so in succession: and yet I believe nobody who ever felt the pain of such a shot, or heard the blow against the two distant walls, could perceive any succession either in the pain or sound of so swift a stroke."

Of these two phenomena a satisfactory account may be easily given; from which we think it will at the same time be apparent, that the succession of the train of ideas in the mind is the measure and standard of all other successions. We know that the energy of mind which reviews a train of sensible ideas is of the very same kind with that which attends to a series of passing sensations (see n° 69); and therefore it is natural to suppose that we can pay attention to sensations and ideas passing with nearly equal velocities. But it has been shown, that every sensation remains in the mind or sensorium for a very short space after the object which excited it is taken away: whence it follows, that a body communicating to the organs of sense a series of similar impressions succeeding each other with remarkable rapidity, cannot excite a train of similar and distinct sensations; because the effects of the first and second impressions not having vanished when those of the third and fourth arrive, the whole train of effects must necessarily coalesce into one uniform sensation. This reasoning is confirmed by experience. Similar sounds succeeding each other at considerable intervals, are all distinctly perceived; and if the motion be accelerated gradually, it may be carried to a great degree of velocity before the sounds be confounded and coalesce into one. "Mr Herschell having, by means of a clock, produced sounds or clicking noises, which succeeded each other with such rapidity that the intervals between them were, as far as could be judged, the smallest possible, found that he could evidently distinguish one hundred and sixty of them in a second of time; but beyond that he could by no effort of attention distinguish one sound from another. The same philosopher tried another experiment on visible sensations. By means of the same handle and work of the clock, he caused a wheel in it to turn till it acquired the velocity of once in a second. He continued to increase the velocity, and observed it while revolving at the rate of twenty times round in thirteen seconds, and could still distinguish the teeth and spaces from each other; whence it appears (by a computation given at length), that he had two hundred and forty-six distinct visible sensations generated by equable motion in a second of time. The teeth of the wheel, he owns, were not so far visible as to show their shape distinctly, much less could they have been counted: but he very plainly distinguished the circumference to be divided into teeth and spaces; and he supposes that the same division might still have been seen though the motion had been a little faster, as far perhaps as two turns in a second, equal to three hundred and twenty sensations*." The reason that the division could not be seen whilst the wheel moved more rapidly than twice round in a second of time, was doubtless the continuance of that agitation in the brain from which each sensation proceeded, until a new impression caused a new agitation, which coalesced with the former and removed all distinction. Hence it is plain, that no external succession can be perceived which moves with a greater velocity than that of which the internal train of sensations and ideas is capable. On the other hand, an external succession which moves with less rapidity than that to which the internal flow of ideas may be reduced, either has not sufficient force to generate sensations at all, or the successive impressions from which the sensations proceed follow one another at such distances as to permit the natural train of ideas to intervene between them, and thus destroy the perception of the succession entirely.

212 The succession of ideas the measure of all other successions,

* Watson's Treatise on Time.

To us, therefore, it seems evident, that the constant and regular succession of ideas in the mind of a waking man, is the measure and standard of all other successions; of which, if any one either exceeds the pace of which our ideas are capable, or falls short of it,

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it, the sense of a constant and continued succession is lost, and we perceive it not but with certain intervals of rest between. So that it is not motion, but the constant train of ideas in our minds, that suggests to us our first notion of time; of which motion no otherwise gives us any conception, than as it causes in our minds a constant succession of sensations: and we have as clear a notion of time by attending to the train of ideas succeeding each other in our minds, as by a train of sensations excited by constant and perceptible motion.

That it is merely by comparing the permanent existence of things with the fleeting succession of ideas in our own minds that we acquire our notions of time, may perhaps be still more evident from the following narrative quoted by Dr Beattie*, from *L'Histoire de l'Acadamie Royal des Sciences pour l'annee* 1719. "A nobleman of Lausanne, as he was giving orders to a servant, suddenly lost his speech and all his senses. Different remedies were tried without effect. At last, after some chirurgical operations, at the end of six months, during all which time he had appeared to be in a deep sleep or deliquium, his speech and senses were suddenly restored. When he recovered, the servant to whom he had been giving orders when he was first seized with the distemper, happening to be in the room, he asked whether he had executed his commission, not being sensible, it seems, that any interval of time, except perhaps a very short one, had elapsed during his illness." If this story be true, here was a man, who, by the train of ideas vanishing at once from his mind, lost the perception of what was to others six months of time; and had all mankind been in his state, the same portion of time would have been irrecoverably lost even to the annals of chronology.

* Essay on Truth.

We are aware of an objection to any inference which may be drawn respecting the present question from the case of this nobleman. It may be said, that he had lost, together with the perception of time, the perception of every thing besides; and that, therefore, motion may still be the cause from which a waking man derives his notions of time. But in reply to this objection, we beg leave to ask, Whether if a ball had been put in motion on a table, and the nobleman had been told, that a body moved with a velocity of that ball would have been carried over so many thousand miles of distance during the time that he lay in a state of insensibility, he could from such information alone have formed any tolerable notion of the length of time in which he was insensible? He certainly could not, for want of a standard by which to measure the rapidity of the motion. He would, indeed, have known instantly that he had been insensible for a considerable length of time, because he had the evidence of former experience that a body carried by perceptible motion over a great extent of distance would have generated in his mind a vast train of successive sensations; but till he had attended this ball during part of its course, and compared with the permanency of other objects the series of sensations which is generated in his mind, he would not have been able to guess with any thing near to accuracy the length of time, it would take to pass over a thousand miles.—The same insensibility of duration happens to every man in sound sleep. From having notions of time, such as they are, formed in our minds, we never indeed suppose, however soundly we have slept, that the moment at which we awake in the morning is contiguous to that in which we fell asleep at night. The reason is obvious; every man has been awake whilst others were sleeping, and has known by experience, that if they had been awake likewise a train of ideas would have passed through their minds which must have suggested to them the notions of time. Most men, too, have been frequently awake whole nights, and have thus acquired a notion of time as going on incessantly, whether perceived y them or not; and this notion being closely associated with ou ideas of night and morning, we inevita bly suppose a portion of time to have elapsed between the, though unperceived by us in our sleep. But were a man to sleep without dreaming from Sunday night till Tuesday morning, and then to awake at his usual hour as marked on the clock, there are numberless instances on record to convince us, that he would not of himself suppose, nor perhaps be very easily persuaded, that more than one night had elapsed between his falling asleep and the moment at which he awoke

It being thus evident, that our notion of time is suggested by that comparison which we inevitably make of the existence of things permanent with the train of ideas incessantly passing through our minds; we may now perhaps be able to answer the question, "What is time?" It must of necessity be one of three things, viz. either the ideal succession itself; a certain quality inherent in all objects; or merely the relation of co-existence between things that are permanent and the trains of fleeting ideas which succeed each other on the theatre of the imagination. It is not the first of these; for in every train of thought, the appearance of any one idea in the mind occupies no more of the extension of time, than a mathematical point occupies of the extension of distance. Ten thousand mathematical points added together, would make no part of a line; and ten thousand ideas made to coalesce, if that were possible, would occupy no part of that mode of duration which is called *time*. A point is the boundary of a line, but no part of it: the appearance of an idea in the mind is instantaneous; and an instant is the boundary, but no part of time. Hence it follows, that were every thing instantaneous like ideas in a train, there could be no such thing as time, since nothing could be said to have in that sense of the word any duration. That time is not a quality inherent in all objects, is likewise plain; for we have seen, that were *ideas* as permanent as objects, the notion of time could never have been acquired. Succession, though it does not itself constitute time, is essential to its existence; and were all motion to cease, and the attention of men to be immoveably fixed upon one invariable object or cluster of objects, *time* would cease likewise. It remains, therefore, that time can be nothing else than the relation of co-existence apprehended between things that are permanent and those trains of fleeting ideas which incessantly succeed each other on the theatre of the imagination. Thus whilst a man is steadily looking at one object, which, from its being common, does not occupy his whole mind, he may be conscious of a thousand ideas starting up in

213 Time a mere relation of co-existence.

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in his imagination, and each in its turn vanishing the instant in which it appeared. Every one of these ideas had an existence as well as the object at which he is looking; but the existence of each of them was instantaneous and in succession, whilst the existence of the external object is permanent. The object therefore, as contrasted with the train of ideas, is said to endure or to exist in time, whilst each idea is destitute of duration, and exists in no time.

214 Objections answered.

To this theory some objections occur, which it will be incumbent upon us to obviate. It may be said, that though each idea considered by itself is instantaneous, and occupies no time; yet the whole train when taken together, without being compared with any thing external, is perceived to occupy a considerable portion of that mode of duration; and that, therefore, time itself must be something more than a mere relation between a fleeting succession of ideas and objects of more permanent existence. But how, we beg leave to ask, is the whole train perceived to occupy any portion of time? Is it not by being compared with our own existence? A man, whilst a train of ideas is passing through his mind, may be suddenly deprived of all his external senses, and then indeed it will be impossible for him to compare the fleeting existence of this internal succession with the more permanent existence of external things; but whilst he thinks at all, he must be conscious of his *own* existence, and cannot avoid perceiving, that whilst his ideas pass in constant succession, each making an instantaneous appearance in his mind, he himself remains unchanged. Now, what is it that this perception suggests to the mind? Evidently nothing more than the relation of co-existence between a fleeting succession and a permanent object; for were it possible that the man could be deprived of memory as well as of his senses, and still have ideas succeeding each other in his mind, he would then think all objects equally fleeting; he would indeed be himself a mere succession of instantaneous distinct persons, and could have no notion whatever of time. His existence, though it should seem to endure half a century as estimated by others, must to himself appear to pass away like a flash of lightening.

It may be still further objected to our theory, that time is measured by motion; and that it seems very absurd to talk of measuring a relation, especially a mere *ideal* relation, by a real external thing. In answer to this objection, which at first sight appears formidable, we beg leave to observe, that relations are equally ideal; and that yet many of them may be said to be measured by real external things, with as much propriety as time can be said to be measured by motion. When a man wishes to ascertain the relation of quantity which one body bears to another, though he knows that such a relation has no other than an ideal existence, and cannot be conceived but in conjunction with the related bodies, he applies to them successively some common standard; and having discovered the relation which each bears to that, he compares the one relation with the other, and thus ascertains the relation sought. Just so it is with respect to motion measuring time. That which to each individual constitutes real time, is the relation of co-existence between the fleeting succession of his own ideas and other things of a more permanent nature. But a man has often occasion to ascertain the time of things external which fall not under the inspection of his senses; and in society all men have transactions with one another to be performed in some determinate portion of time, though there are not, perhaps, two men existing whose ordinary trains of thought flow with precisely the same rapidity. To remedy these inconveniences, it was necessary to invent some common standard, by means of which men might ascertain the duration of actions performed at a distance, and be able to keep appointments made with each other. The only standard proper for these purposes is such a constant and equable motion as has suggested a flux of perceptions common to all men in all ages and countries; and hence the motions of the heavenly bodies have been universally made use of for the common regulators of time. These motions, however, do not constitute real and natural time, any more than a foot or a yard applied to two distant bodies constitutes the relation of quantity which these bodies bear to each other. They are merely stated measures, to be differently applied according to the different purposes which we have in view.

Thus, if a man in Europe wishes to know what would to him have been the *real* and *natural* time of an action performed in the East Indies, he has only to be told, that it was co-existent, we shall suppose, with a diurnal revolution of the earth; and by comparing this common measure with his usual flow of thought, he can form some notion of the extent of that train of ideas, which, had he been present, would to him have been successively co-existent with the action in question. But when persons have an appointment to keep, this common measure of motion must be differently, or rather partially, applied. In such cases, it is no part of their intention to compare their own existence with that of the whole train of ideas which may pass in the mind of each; for the result of such a comparison, which alone constitutes true and natural time, would not be the same in perhaps any two men: but their purpose is, to compare their own permanent existence only with that train of sensations which shall be excited in the mind by the perceptible motion of the sun, or any other body fixed upon which moves equably; and such a train must consist of an equal number of instants in all men. Neither the sun, nor the hour-hand of a common watch, moves with such apparent rapidity as to keep pace with the internal flow of thought of which the most phlegmatic man is conscious. That these bodies move at all, is known only by their visible change of place during the lapse of a considerable portion of real time; and as there is in their course a certain number of places distinctly marked, to which alone it is agreed that the attention is to be turned, it is impossible that of time so computed two men can have different notions. Such time, however, is but partial; and the method of ascertaining it, when compared with that by which we ascertain real time, has a striking resemblance to that by which we ascertain the relation of partial quantity between two distant bodies. When it is our purpose to ascertain the relation of real quantity which one body bears to another, we apply the common standard to each in every dimension of length, breadth,

Of Time.

breadth, and depth; but when we have no other view than to ascertain the relation of length which the one bears to the other, we apply the common standard to each in that dimension only. Just so it is with regard to real and partial time. When an individual wishes to ascertain what would to him have been the duration of any action which he did not see performed, he applies the common standard to the existence of that action, and to the usual flow of his own thoughts; but when two men talk of the duration of any action, or agree to meet on such a day, they compare the existence of the action, or the distance intervening between the present moment and the day of meeting, only with that partial train of sensations which by the common standard is generated in an equal number, and in the same order, in the minds of both.

215 Time must have had a beginning.

It will be said, that if time be nothing more than a mere relation subsisting between trains of ideas or other fleeting objects, and things of a more permanent existence; and if the universe had a beginning; either time must have had a beginning likewise, or the Deity cannot be immutable. We allow the force of the argument; but instead of an objection, we consider it as a confirmation of the truth of our theory. The Deity, who is immutable, exists not in time, but in eternity; and that these, though from the poverty of language they are both called modes of duration, are yet very different from each other, we shall endeavour to prove in the next chapter.

Chap. VIII. *Of* Infinity *and* Eternity.

216 Why we treat of infinity and eternity among the adjuncts of body.

As corporeal substance is certainly not infinite, and as the present material system has in itself every evidence of its not being eternal, it may seem strange, perhaps, to the reader, that we should treat of infinity and eternity among the adjuncts of body. But in modern metaphysics these words are used in a vague sense to denote the extent of space and time; and in this chapter it is our intention to do little more than ascertain their meaning, and to show, in opposition to some celebrated names, of what subjects they may not be predicated. There is a mathematical and a metaphysical infinity, which, though often confounded, ought to be kept distinct. In mathematics, extension is said to be divisible *ad infinitum*, and number is sometimes considered as infinite: but in metaphysics these modes of expression are extremely improper. A positive and metaphysical infinite is that which has no limits, and to which no addition can be made; but it is obvious that there is no number which may not be enlarged, nor any positive idea of extension which has not limits, and which may not be either increased or diminished. The infinity of the mathematician is termed *infinity in power*, and that of the metaphysician *absolute infinity*. The first consists in this, that a being, however great or small it be supposed, may still be conceived to possess more greatness or minuteness than we can form an idea of, even after the utmost stretch of human thought. Thus when it is said that all extension as such is infinitely divisible, it is not meant that every extended substance contains an infinite number of *real parts*; for then the parts of an inch would be equal to those of a league: but the meaning is, that in ideal extension we can never reach the end of ideal division and subdivision. In like manner, when it is said that number is infinite, the meaning is not that any positive number is without limits, or the possibility of increase, but that we might go on for ever, adding unit to unit, without approaching nearer to the end of the process. If, therefore, the mathematician would speak properly, and without the affectation of paradox, he ought to say that all extension as such is *indefinitely* divisible, and that unit might be added to unit without end; but these phrases suggest notions very different from that of a metaphysical infinite, which is something positive to which nothing can be added (B).

Of Infinity and Eternity.

217 Space and time supposed to be, the one infinite, and the other eternal:

That there is something positively infinite, has been very seldom questioned; but it has been warmly disputed among metaphysicians what subjects are infinite. Dr Clarke and his adherents have contended that space and time are real things; that they are both of necessary existence; that the former impresses us with the idea of its infinity, and that the latter is positively eternal. "Time and space (says the Doctor*) are the *sine qua non* of all other *things*, and of all other *ideas*. To suppose either of them *finite*, is an express *contradiction* in the idea itself. No man *does* nor *can* possibly *imagine* either of them to be finite; but only either by *non-attention*, or by *choice* he attends perhaps to *part* of his *idea*, and *forbears attending to* the remainder. They who suppose *space* to be nothing but a *relation between two bodies* are guilty of the absurdity of supposing that which is *nothing* to have *real qualities*: *For the space which is between two bodies* is always unalterably just what it was, and has the very same dimensions, quantity, and figure, whether *these* or any *other bodies* be there or any where else, or not at *all*. Just as *time* or *duration* is the same, whether you turn your *hour-glass* or no, or whether the sun moves or stands still, or whether there *was* or *was not any sun*, or any *material world* at all. To set *bounds* to space is to suppose it *bounded* by something which itself *takes up space*, and that's a *contradiction*; or else that it is *bounded by nothing*, which is another contradiction. To suppose space *removed*, *destroyed*, or *taken away*, amounts to the absurd supposition of removing a thing away *from itself*; that is, if in your *imagination* you *annihilate* the *whole* of *infinite space*, the whole of *infinite space* will still remain; and if you annihilate any *part* of it, *that part* will still *necessarily* remain, as appears by the unmoved situation of the *rest*; and to suppose it *divided* or *divisible* amounts to the same contradiction."

* Demonstration of the Being and Attributes of God, and Correspondence with a Gentleman of Gloucestershire.

The absurdity of considering space as a real external thing has been already evinced in chap. 4th, p. 549, where it was shown how we acquire the notion, and what kind of notion it is. Space, as was there observed, may be conceived either as the mere absence and possibility of body; or as ideal extension, united to, and inhering in, an ideal substratum. Taken in the former sense, it is an object of pure intellect; in the latter, it is

(B) Ου γαρ ου μηδεν εξω αλλ ου αει τι εξω εστι, τουτο ατειρον εστι. *Arist. Phys. Auscult. Lib.* 9. *cap.* 9. *page* 492, *Tom.* 1. *Oper.*

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is an *idea* or *form* in the imagination. That the absence of body or matter is the *sine qua non* of all other things, and all other ideas, Dr Clarke was not disposed to affirm, when he made the divine substance, to pervade every material atom in the universe; and to talk of the absence of body being infinite is a palpable contradiction, unless Berkeley's doctrine be true, that the material world has no existence. To say that the *possibility* of matter is infinite, is to use language which has no other meaning than that, however far the material world be on all sides extended, its extension may still be conceived greater and greater *ad infinitum*. This is a position which no philosopher ancient or modern has ever denied; but it is so far from implying that we have a positive idea of the infinity of the material world, or of any adjunct of the material world, that it is absolutely inconsistent with such infinity. Whatever is capable of perpetual increase must certainly have limits, and every new addition is the limit of that to which the addition was made.

218 but improperly.

Taken in the second acceptation as an ideal extension united with an ideal *substratum*, space is so far from being infinite in any sense of the word, that we will venture to assert no man ever contemplated such a *form* in his own imagination, without conceiving it to be bounded. Of this, at least, we are certain, that when we have attempted to frame a positive idea of pure space, it has not been in our power to divest that idea of limits. Those who can frame in their minds real and positive ideas wholly abstracted from every individual object, may indeed perform in this way many feats above our abilities; but as we possess no such powers of abstraction, every thing which we can call an idea is limited in the same manner that the object itself is limited from which the idea was derived.—Thus, the largest expansion that ever we beheld is the concave hemisphere; and when we try to form the largest positive idea of pure space, all that we can do is to figure to ourselves that concave empty of body. We may, indeed, suppose its diameter to be either a million or ten thousand millions of miles; and we may go on enlarging it *ad infinitum*: but when we return from this process of intellect to the contemplation of the ideal forms in the imagination, none of these forms appear to us larger or more extended than the hemisphere, which is the object of sense, and they all appear to be bounded, and bounded in the very same way.

119 Neither space nor

With respect to the eternity of time, we think Dr Clarke equally mistaken as with respect to the infinity of space. Of time, indeed, we cannot properly speaking have any *idea* or mental *form*. Time, as we have seen, is a mere relation, and is in itself the creature of the mind which has no external *idiatum*. It is suggested, however, by the fleeting succession of our ideas, compared with the more permanent existence of other objects; and therefore succession is essential to it. But nothing which has parts, whether co-existent or in succession, can be positively infinite. For, "in an infinite series of successive generations of men, for instance, there will be several infinites that are parts of one another, and by consequence one greater than another: which (as has been well argued *) is an express contradiction, since the greater must necessarily bound the less, and exceed its limits by so much as it is greater than it; that is, must make it not infinite. Infinite generations contain an infinitely greater infinity of particular men. An infinite number of men must have twice as many hands, and ten times as many fingers, and so on. Infinite time has an infinity of ages; these a much greater infinity of years, days, hours, &c. Space likewise (according to Dr Clarke) has three dimensions, all infinite. It must, therefore, contain an infinity of surfaces, an infinitely greater infinity of lines, and a still infinitely greater infinity of physical points. The case is the same in number itself, which, if we suppose it to contain an absolute infinity of thousands (and we may as well do that as imagine it to comprehend an infinity of units), it will contain ten times as many hundreds, fifty times as many scores, and so on All this is only the *indefiniteness* of number, which we in vain attempt to turn into a positive infinite with which it is totally incompatible. For let us add *one* to any of these infinite series of generations, ages, lines, or numbers, which we know to be always in our power, and if it was absolutely infinite before, here is one more than infinite. If it only becomes infinite now, then one finite added to another finite makes infinity. If it be no larger after the addition than it was before, then one part added to another adds nothing; all which are absurdities. The same will appear, if we substract a part from this supposed absolute infinite, which may be done in any of the formentioned subjects, as well as in every thing which admits of parts, or may be taken in pieces by the mind."

220 time can be positively infinite; and why.

* Dr Law's Inquiry into the Ideas of Space, Time, Immensity, and Eternity. See also the same acute writer's translation of King's Origin of Evil.

221 The usual reply to the foregoing reasoning shown

To this kind of reasoning Dr Clarke replies as follows: "To endeavour to prove that there cannot possibly be any such thing as *infinite time* or *space*, from the impossibility of an addition of finite parts ever composing or exhausting an infinite; or from the imaginary inequality of the number of years, days, and hours, that would be contained in the one; or of the miles, yards, and feet, that would be contained in the other, is supposing infinites to be made up of numbers of finites; that is, it is supposing finite quantities to be *aliquot* or *constituent parts* of infinite, when indeed they are not so, but do all *equally*, whether *great* or *small*, whether *many* or *few*, bear the very same proportion to an infinite, as mathematical points do to a line, or lines to a superficies, or as moments do to time, that is, none at all. No given number or quantity can be any *aliquot* or *constituent* part of infinite or be compared at all with it, or bear any kind of proportion to it, or be the foundation of any argument in any question concerning it."

If it be indeed true, and it is that for which we contend, that no given number or quantity can be any aliquot or constituent part of infinite, or be compared at all with it; then it undeniably follows, not that miles, yards, and feet, are no constituent parts of space; or years, days, and hours, constituent parts of time; but that space and time cannot possibly be positive infinites. This, we say, follows undeniably: for nothing is more evident, than that all quantities of the same kind, from the largest to the least, bear a certain proportion to each other; and upon the supposition that space is a real extended thing, miles, yards, and feet are included in it, and bear to it the relation of parts to a whole. The same is true of time, days, and hours. To affirm (for no proof is offered), that

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all finite quantities, whether great or small, whether many or few, do equally bear the very same proportion to an infinite, as mathematical points do to a line, or as moments do to time, is plainly to beg the question—"that *space* considered as a real extended thing is *infinite;*" and to beg it, too, in opposition to the common sense and reason of mankind. Mathematical points we all know to be nothing real, but merely negations of extension; but supposing space to be something real and extended, can any man persuade himself that a mile or a million of miles of this space is likewise a mere negation of extension? With him who can bring himself to this persuasion, we pretend not to argue. He is possessed of faculties, whether true or false, of which we are destitute.

222 to be a petitio principii.

That finite quantities, whether great or small, do all equally bear the same proportion to an *infinite in power*, is indeed true; but it is no great discovery: for such an infinite, as we have seen, is nothing but the continued possibility of repeating the same mental process of addition or multiplication; and he who can go on for ever adding, in his own imagination, foot to foot, or hour to hour, will find it equally easy to add, in the same manner, league to league, or age to age. If he can perform the one operation, he must likewise have power to perform the other; and he cannot but perceive that it is as impossible to come to an end of adding league to league, or age to age, as of adding foot to foot, or hour to hour; but then he must know that these leagues, feet, ages, and hours, are not real external things, but mere ideas and notions in his mind. If such powers of ideal multiplication and addition be what Dr Clarke means by the ideas of space and time, it is indeed a contradiction to suppose either of them limited; for that is to suppose our powers different from what we know them to be by consciousness and experience. But to confound *powers* with the *objects* of those powers, is certainly very inaccurate; and to suppose, because we can go on for ever adding one portion of ideal space or time to another, that therefore our ideas of space and time are in themselves positively infinite, is a contradiction: for to an idea positively infinite, it is obvious that nothing can be added. Either, therefore, space and time do not impress us with the ideas of their positive infinity; or we cannot have the power of adding league to league, and age to age, without end.

"But (says the Doctor), to suppose space removed, destroyed, or taken wholly away, amounts to the absurd supposition of removing a thing from itself; that is, if in your imagination you remove the whole of space, the whole of space will still remain." True, every man has ideas of space treasured up in his imagination, which the sound of the very word space will at all times bring into his immediate view; and whilst he has such ideas, it is impossible that he should not have them; which is all the mystery of the matter, and amounts to nothing more than that a thing cannot be and not be at the same instant. When the Doctor affirms, that if "you annihilate any part of space, that part will necessarily remain, as appears by the unmoved situation of the rest", we are not certain that we perfectly understand him. A man may surely think of a cubical inch without thinking of a foot or a yard; and he may suppose the inch taken away from the foot or the yard, and these ideal quantities so much lessened by the subtraction. But if the Doctor be here again confounding the powers of the mind with the positive ideas of space, the sentence when explained will be seen to contain nothing to his purpose. Every man has the power of contemplating in idea millions of miles, and millions of ages, and of adding mile to mile, and age to age, without end; and if he try to deprive himself of any part of this power, or to fix a limit to the mental process of addition, he will find that in spite of himself his imagination will ramble beyond the limit assigned, and that he has attempted an impossibility. This, however, is so far from being a proof that his ideas of space and time are positively infinite, that, as we have already observed, it is a proof of the contrary.

223 Space and time are said to be the sine qua non of all other things; but

But (say this great man and his followers) "space and time are the *sine qua non* of all other things and all other ideas. The supposal of the existence of *any thing whatever* includes necessarily a *presupposition* of the existence of *space* and *time;*" and therefore, if there be any thing infinite and eternal, space and time must likewise be so.

To every corporeal substance, and every idea of such substance, space and time are indeed necessary: for every body has extension and duration; and every idea of a particular body, being nothing but a secondary perception in the imagination or memory, must have the same relation to imaginary extension, that the object from which it was derived has to extension which is real. Every idea, too, which remains in the imagination whilst a train of other ideas passes successively in view, or whilst external things are perceived to change, has real time. But will any man say that *consciousness*, our notion of *power*, our acts of *willing*, or even *tastes*, *sounds*, and *smells*, are extended, or that the supposal of their existence necessarily implies a presupposition of the existence of space? We acquire our ideas of extension and space by means of our senses of touch and sight; and we learn from experience, that things external and extended are the causes of our sensations of taste, sound, and smell. The effects are in our minds closely associated with the ideas of their causes; and it is not perhaps easy to think of a particular sound, taste, or smell, without at the same time thinking of the object by which it was at first excited in the mind: but had we been originally formed with the powers of consciousness, thinking, and willing, and with no other senses than those of tasting, smelling, and hearing, it is obvious that we never could have had the idea of *space;* and therefore, that idea cannot possibly be necessary to the presupposition of every thing else. To consciousness, thinking, and willing, space is so far from being necessary, that we cannot perceive any the most distant relation between them. It is not more difficult to conceive a part greater than the whole, than it is to conceive an ell of *consciousness*, of *thought*, or of *will;* nor is it in the power of any man to make *space* and *sweetness* coalesce in his mind so as to form of the two simple ideas one complex conception. The very reverse is the case with respect to the objects of sight and touch. The idea of every thing which we see and handle necessarily

224 there are things which have no relation whatever to space, or

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ly coalesces in the mind with the idea of space, nor can we possibly separate the one from the other; but the things which we see and handle are neither infinite nor capable of infinity.

225 to time.

With respect to time, the same observations will be found to be just as with respect to space. Whatever is liable to change, exists in time and cannot be eternal; but if there be any being immutable, and who views at once all things which to us are past, present, and to come, the existence of that being is not commensurable with time. That such a being is possible no man can doubt, who reflects, that if we had one permanent idea invariably in the mind, we should never have acquired the *notion* of succession or of time; and that if there were *actually* no *change* in nature there could not possibly in nature be any such *thing as time*. Every man, therefore who can conceive existence without change, must be convinced, that "the supposal of the existence of any thing whatever does *not* necessarily include the presupposition of the existence of time, and that there may be an eternity distinct from time, as well as an infinity distinct from space; nay that nothing which is properly infinite and eternal can possibly occupy either space or time.

226 Infinity and eternity, what they are.

If it be asked, what kind of infinity and eternity they are which have no relation to space and time? Cudworth, treading in the footsteps of the ancients, has long ago answered, that they are "absolute perfection, and necessary existence. For (says he), *infinite understanding* and *knowledge* is nothing else but *perfect* knowledge, which hath in it no defect or mixture of ignorance, but knows whatsoever is knowable. In like manner, *infinite power* is nothing else but *perfect* power, which hath in it no defect or mixture of impotency—a power which can do every thing which is possible or conceivable. Lastly, *infinity of duration*, or *eternity*, is really nothing else but *perfection*, as including in it *necessary existence* and *immutability*; so that it is a contradiction to suppose such a being to have had a beginning, to cease to be, or to suffer or be affected by any change whatever. And because infinity is perfection, therefore nothing which includes in its idea or essence any thing of *imperfection*, as every positive idea of number, corporeal magnitude, and successive duration evidently does, can be truly and properly infinite." *

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It must indeed be confessed, that the idea of succession so insinuates itself into our usual ideas of existence, and is so closely connected with the existence of all finite beings, that we find it extremely difficult to imagine the eternal existence of God, any otherwise than as an eternally continued series or succession. Our constant conversation with material objects, and the associations thence arising, make it almost impossible for us to consider things abstracted from time and space; yet we have the evidence of experience and consciousness, that an idea may be conceived without relation to space and time, and that space and time cannot be made to coalesce with some of our notions. The same must be true with respect to infinity and eternity; for we have seen that neither space, time, nor any thing else which consists of parts, whether continuous or successive, can be supposed to be positively infinite, as the supposition implies the most palpable contradiction. But that there may be perfect power, perfect knowledge, and permanent invariable existence, is so far from implying any contradiction, that even we, whose faculties are so very narrow, can yet make some advances towards the conception of such perfections. Thus, every man of common understanding knows that some things are in themselves possible, and others impossible, to be performed by any power. Of these possibilities and impossibilities a philosopher knows more than an illiterate man; and one philosopher knows more than another. An intellect more perfect knows more of them than any man; and that intellect which knows them all must be absolutely perfect, and incapable of improvement, because it knows every thing which is to be known. The same is true of perfect power:—but we shall treat of real infinity and eternity more at large when we come to demonstrate the being and attributes of God. At present it is sufficient to have shown, that nothing can be positively infinite but a being absolutely perfect; which never was not, which can produce all things possible and conceivable, and upon which all other things must depend.

* Intellectual Systems.

PART III. OF MINDS AND THEIR POWERS.

CHAP. I. *Of* MIND *in* GENERAL.

THE science of metaphysics comprehends every thing into the existence, nature, or causes, of which any inquiry may be made. But all things of which we have any notion or idea may be divided into mind and body, with their various powers, qualities, and adjuncts. By body is meant that which is solid, extended, inert, and divisible; and its several adjuncts are space, motion, number, and time. The only mind with which we are *intimately* acquainted is our own; and we know that it is possessed of the powers of sensation, perception, retention, consciousness, reflection, reason, and will. These are totally different from extension, solidity, divisibility, and motion; and therefore it is proper to distinguish the being of which they are powers by another name than that of body.

227 Mind Distinguished from body.

228 Probably minds of different orders.

Of bodies there are various kinds possessing various sensible qualities; and from analogy it is reasonable to conclude, that there may be various classes of minds endowed with different kinds or degrees of power. For this indeed we have stronger evidence than that of analogy. Brute animals evidently possess the powers of perception and spontaneity with some degree of consciousness; but as they appear not to reflect upon their own conduct, or to have their actions influenced by motives, their minds are inferior to ours, though still perfectly distinct from mere extended, inert, and divisible substances. Mind, therefore, considered with respect to its powers, is evidently different from body considered with respect to its qualities. This is indeed

Of Mind in general.

a truth which has seldom if ever been controverted; but it has been long and warmly disputed, Whether mind and body be not both composed of the same first matter?

229 The absurd hypothesis of Hobbes respecting mind.

Hobbes supposed, that every material atom is endowed with the faculty of sensation (c); but that for want of memory each sensation is momentaneous, being instantly and wholly effaced as soon as its cause is removed. Though this hypothesis is too absurd to require a formal and laboured confutation, it may not be improper to observe, that, if it were true, the hairs of a man's head would feel extreme pain when pinched by the hot iron of the hair-dresser; and that the nails of his fingers would be severely tortured when under the operation of the knife or the rasp.

230 Other absurd hypotheses.

Others have supposed that each atom of matter has a *tendency towards* sensation and perception; and that when a sufficient number of these atoms are brought together in a certain order, the *united tendencies* produce the *actual* powers which distinguish mind from gross body. This supposition is if possible more absurd than that of Hobbes. Sensation and perception are of such a nature, that a mere *tendency towards* them is inconceivable. A thing must either be sensible and percipient, or insensible and inert: there is evidently no medium. Or if we could suppose each individual atom to have a *tendency* towards sensation, it would by no means follow that a number of such atoms brought together in any possible order would become one sentient, thinking, and active being. A number of bodies laid upon an inclined plain have each a *tendency* to roll downwards; but if the declivity of the plain be not such as that their separate tendencies may overcome the resistance opposed to each individual body by friction, the *united tendencies* of all the bodies when brought together will not be able to overpower the resistance of their united frictions. Just so is it with respect to sensation and perception: If the tendency of one atom cannot overcome one degree of inertness, the tendency of a thousand atoms will not overcome a thousand degrees of the same inertness.

231 Only two opinions at present on the subject.

We have just mentioned these absurd suppositions that our article might be complete: but it is proper to inform the reader, that, so far as we know, neither of them has for these many years been maintained by any philosopher of eminence either at home or abroad. The opinions on this subject, which at present divide the republic of letters, are two; and these alone are worthy of examination. One party maintains, That perception, memory, reason, and will, &c. are the powers of a being which must be immaterial and indivisible: The other alleges, That as we know nothing of these powers but from our own consciousness, and as we can trace them in ourselves to the brain and no farther, we have no reason to suppose that they are the powers of any substance distinct from matter. Both parties, however, distinguish that which in man is the subject of thought from his external organs of sense. and agree to call it by the name of *mind*; though the one considers it as composed of the same first matter with the dust of the ground; whilst the other believes it to have no property whatever in common with that matter.

Of Mind in general.

Were we to adopt some of the ancient methods of philosophising, this important question might be soon decided. A most respectable writer, who has laboured to restore the metaphysics of Plato and Aristotle, hopes to confute the materialists, by laying down what they must think arbitrary definitions of mind and matter, and then showing that the one is not the other. "In all the parts of the material world (says he) there is a perpetual *motion*: For the celestial bodies move constantly in one respect or another; and all here below is in a continual vicissitude of generation and corruption, which cannot be without *motion*. Now, where there is *motion*, there must be something that *moves*: What is *moved* I call *body*; what moves I call *mind*." From this definition he undertakes to prove, that mind must be immaterial. "That there is a relation between *moving* and *being moved* (says he), nobody can deny; and the relation is no other than that of *action* and *passion*. But the nature of relation is such, that it must necessarily be between two things at least; and it is further necessary, that the two things related should exist together. Hence, if there be that which *moves*, there must be a different thing that *is moved*; and wherever the one is, the other must necessarily be; so that nothing can move itself. This being established, I say that what *moves* must be either material or immaterial: for the one of these being the negation of the other, there can be no middle betwixt them, because a thing must necessarily *be*, or not *be*. If then it be immaterial, there is an end of the question: but if it be said to be material, then I say that it must be *moved* itself before it can move any thing else; for it is only in that way that body can move body. If then it must be first moved itself, but cannot itself move itself, what is it that moves it? If it be answered, That it is another material mover, then I repeat the same question, to which the same answer must be given: and so we have an infinite series of *material movers*, without any beginning or *principle* of *motion*. Now this is absurd, and contradictory to this first principle of natural philosophy, admitted by all philosophers ancient and modern, That *nothing can be produced without a cause* ‡."

‡ Ancient Metaphysics.

For the immateriality of the human mind, and of every being endowed with the powers of perception and thought, the learned writer has better arguments; but it is upon this chiefly that he rests his persuasion, that mind is the only *mover* in the universe. It is needless to observe, that in the very definitions and axioms upon which this reasoning is built, the thing to be proved is taken for granted: for if it be self-evident,

(c) Scio fuisse philosophos quosdam, eosdemque *viros doctos*, qui corpora omnia sensu prædita esse sustinuerunt: *Nec video*, si natura sensionis in reactione sola collocaretur, QUOMODO *refutari possint*. Sed etsi ex reactione etiam corporum aliorum, phantasma aliquod nasceretur; illud tamen, remoto objecto, statim cessaret. Nam nisi ad retinendum motum impressum, etiam remoto objecto, apta habeant organa, ut habent animalia; ita tantum sentient, ut nunquam sensisse se recordentur. Sensioni ergo, quæ vulgo ita appellatur, necessario adhæret memoria aliqua. *Hobbes's Physic*, cap. 25. sect. 5.

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dent, that what *moves* is, in the author's sense of the word, *mind*, that what is *moved* is *body*, and that *nothing can move itself*; all reasoning on the subject is superfluous. This, however, is so far from being self-evident, that a materialist may reply, "every animal moves itself, and yet every animal is nothing more than a system of matter." This position, whether true or false, can neither be proved nor confuted by arguments *à priori* founded on general definitions. That animals move themselves, and that to the senses they appear to be nothing else than systems of matter, are facts which cannot be controverted. If we would know whether they have in them a principle of motion which is not material, we must submit to the laws of induction (see LOGIC); and by investigating the essential qualities of matter, endeavour to ascertain whether a material system can be rendered active. That we ourselves have active powers, we know by the most complete of all evidence, *viz.* consciousness of their energies; and it has been already shown, that such powers as we experience in ourselves cannot exist but in a subject possessed of will and understanding. The question therefore to be first decided between the materialists and immaterialists is, Whether the powers of consciousness, understanding, and will, can result from the particular organisation of a system of matter? If they can, we have no reason to attribute them in man to any other source: If these powers appear necessarily to require an immaterial principle for their support, it will probably be granted, that an immaterial principle is the source of every power and every motion in the universe; and the doctrine of *mind*, in the strictest sense of the word, will be sufficiently established.

232 The proper method of investigating the nature of mind.

CHAP. II. *Of the* SUBSTANCE *of the* HUMAN MIND.

THE most celebrated materialist of this or perhaps of any other age is Dr Priestley; who having in his own imagination divested matter of solidity, and reduced it to mere centres of attraction and repulsion, observes, that "if one *kind of substance* be capable of supporting all the known *properties* of man; that is, if those properties have nothing in them, that is absolutely incompatible with one another; we shall be obliged to conclude (unless we openly violate the rules of philosophising, which will not authorise us to *multiply causes* or kinds of substance *without necessity*), that no other kind of substance enters into his composition; the supposition being manifestly *unnecessary*, in order to account for any appearance whatever.—All the properties that have hitherto been attributed to matter, may be comprised under those of attraction and repulsion. Besides these, man is possessed of the powers of *sensation* or *perception*, and *thought*. But if, without giving the reins to our imaginations, we suffer ourselves to be guided in our inquiries by the simple rules of philosophising abovementioned, we must necessarily conclude, that these powers also may belong to the same substance that has also the properties of attraction, repulsion, and *extension* (D), which I as well as others call by the name of *matter*. The reason of the conclusion is simply this, that the powers of sensation or perception and thought, as belonging to man, have never been found but in conjunction with a certain *organised system of matter*; and therefore that those powers necessarily exist in and depend upon such a system. This at least must be our conclusion, till it can be shown that these powers are incompatible with the other known properties of the same substance; and for this I see no sort of pretence."

233 Arguments for the immateriality of the human mind.

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This is what Dr Priestley calls the proper and direct proof that the sentient principle in man is the material substance of the brain; and he enforces it by the following observations: "Had we formed a judgment concerning the necessary seat of thought by the circumstances that *universally accompany it*, which is our rule in all other cases, we could not but have concluded that in man it is a property of the *nervous system*, or rather of the brain; because, as far as we can judge, the faculty of thinking, and a certain state of the brain, always accompany and correspond to one another; which is the very reason why we believe that any property is inherent in any substance whatever. There is no instance of any man retaining the faculty of thinking when his brain was destroyed; and whenever that faculty is impeded or injured, there is sufficient reason to believe that the brain is disordered in proportion; and therefore we are necessarily led to consider the latter as the seat of the former. Moreover, as the faculty of thinking in general ripens and comes to maturity with the body, it is also observed to decay with it; and if, in some cases, the mental faculties continue vigorous when the body in general is enfeebled, it is evidently because in those particular cases the *brain* is not much affected by the general cause of weakness. But, on the other hand, if the brain alone be affected, as by a blow on the head, by actual pressure within the skull, by sleep, or by inflammation, the mental faculties are universally affected in proportion. Likewise, as the mind is affected in consequence of the affections of the body and brain, so the body is liable to be reciprocally affected by the affections of the mind, as is evident in the visible effects of all strong passions, hope or fear, love or anger, joy or sorrow, exultation or despair. These are certainly irrefragable arguments, that it is properly no other *than one and the same thing* that is subject to these affections, and that they are necessarily dependent upon one another. In fact, there is just the same reason to conclude, that the powers of sensation and thought are the necessary result of a particular organization, as that sound is the necessary result of a particular concussion of the air. For in both cases equally the one constantly accompanies the other; and there is not in nature a stronger

(D) When Dr Priestley mentions the *extension* of corporeal substance, it must be remembered that he does not mean the extension of any real thing possessed of an independent existence. The extension belongs wholly to the *sphere* or the *combination* of spheres of *attraction* and *repulsion*. The centre itself, which attracts and repels, he repeatedly affirms not to have the dimensions even of a physical point; and he sometimes seems to entertain a doubt whether it be any thing more than a mere relative notion.

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stronger argument for a necessary connection or any cause and any effect. To adopt an opinion different from this, is to form an hypothesis without a single fact to support it." *

* Disquisitions on Matter and Spirit.

Though the ingenious author thinks, that if there be any foundation for the established rules of philosophising, this reasoning ought to be conclusive, he yet subjoins, for the greater satisfaction of his readers, some additional arguments or rather, as he says, distinct illustrations of the great argument. They are as follows.

1. "That the faculty of thinking necessarily depends, for its *exercise* at least, upon a stock of ideas, about which it is always conversant, will hardly be questioned by any person. But there is not a single idea of which the mind is possessed but what may be proved to have come to it from the bodily senses, or to have been consequent upon the perceptions of sense. The notion, therefore, of the *possibility* of thinking in man, without an organized body, is not only destitute of all evidence from actual appearances, but is directly contrary to them; and yet these appearances ought alone to guide the judgment of philosophers.

2. "The only reason why it has been so earnestly contended for, that there is some principle in man that is not material, is, that it might subsist, and be capable of sensation and action, when the body is dead. But if the mind was naturally so independent of the body, as to be capable of subsisting by itself, and even of appearing to more advantage, after the death of the body; it might be expected to discover some signs of its independence before death, and especially when the organs of the body were obstructed, so as to leave the soul more at liberty to exert itself; as in a state of *sleep* or *swooning*, which must resemble the state of death; in which it is pretended that the soul is most of all alive, most active, and vigorous. But judging by appearances, the reverse of all this is the case.

3. "If the mental principle was, in its own nature, immaterial and immortal, all its particular faculties would be so too; whereas we see that every faculty of the mind without exception is liable to be impaired, and even to become wholly extinct, before death. Since, therefore, all the faculties of the mind, separately taken, appear to be mortal, the substance or principle in which they exist must be pronounced to be mortal too.

4. "If the sentient principle in man be immaterial, it can have no *extension*; it can neither have length, breath, nor thickness; and consequently every thing within it, or properly belonging to it, must be *simple* and *indivisible*. Let us now consider how this notion agrees with the phenomena of sensation and ideas. It will not be denied, but that sensations or ideas properly exist *in the soul*, because it could not otherwise retain them, so as to continue to perceive and think after its separation from the body. Now, whatever ideas are in themselves, they are evidently produced by external objects, and must therefore correspond to them; and since many of the objects or archetypes of ideas are divisible, it necessarily follows, that the ideas themselves are divisible also. But, how is it possible that a thing (be the nature of it what it may) that is *divisible*, should be contained in a substance, be the nature of it likewise what it may, that is *indivisible*? If the archetypes of ideas have extension, the ideas which are expressive of them, and are actually produced by them according to certain mechanical laws, must have extension likewise; and therefore the mind in which they exist, whether it be material or immaterial, must have extension also. But how any thing can have extension and yet be immaterial, without coinciding with our idea of mere empty *space*, I know not."

To the argument, which is here chiefly insisted on as being agreeable to the established rules of philosophising, a very able reply has been made, which we shall give in the words of its elegant and spirited author. But before we attempt to dig up the foundation of the Doctor's system, it may not be improper to demolish, if possible, the additional buttresses by which it is strengthened. An experienced general, before he storm a citadel which he knows to be strongly fortified and skilfully defended, will take care to raze every less important redoubt from which the enemy might annoy him in his rear.

234 Answered.

Because the faculty of thinking in general ripens, comes to maturity, and decays with the body, and the body on the other hand is affected by the affections of the mind, the Doctor affirms that we have the same reason to conclude, that the powers of sensation and thought are the necessary result of a particular organization, as that sound is the necessary result of a particular concussion of the air. This argument is conclusive only upon the supposition that there is no *positive* evidence whatever for the immateriality of the being which is the subject of thought. If the other reasonings for the materiality and immateriality of the mind be of equal weight, this argument ought doubtless to turn the balance; but if there be the smallest preponderancy in behalf of the immaterialists, it is a mere begging of the question to attempt to counteract it by any inference which can be drawn from the mutual affections of the body and mind. If two such heterogeneous beings as an immaterial mind and an organised body can be supposed united in one person, they must necessarily affect each other; and to affirm, on account of this reciprocal affection, that they are *one and the same*, is equally absurd as to say that an electrician and his apparatus are *one and the same*. Dr Priestley himself did not at first perform his electrical experiments with so much ease as after he had acquired facility by long practice, nor could he even yet perform them so neatly with a bad as with a good apparatus.

That which the Doctor calls the first illustration of his argument might be admitted, and the force of the argument itself be consistently denied. Some kind of organised body may be necessary to the mind as an instrument without which it could not exert its faculties; but it would certainly be rash to infer that the mind must *therefore* be a system of matter. An anvil and a hammer are necessary to the exercise of the blacksmith's art; but what would be thought of him who should from this fact conclude, that the blacksmith himself must be a system of iron? This, therefore, instead of illustrating the great argument, seems to be wholly foreign from the question in debate; and it has in fact been admitted by Dr Price *, and thousands of others who reject the doctrine of materialism, as an impious absurdity. The second illustration

* Correspondence with Dr Priestley.

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† Religion of Nature Delineated.

lustration, however, is more to the purpose; and as it is not new, we shall give it an old answer.

Why do not we perceive external objects in our *sleep* or in a *swoon?* "Because (says Mr Wollaston), † the *passages* are become impracticable, the *windows* shut, and the *nerves* being obstructed, or somehow rendered for the time useless, can transmit no information to it. Why, however, does it not reason and think about *something or other?* Because, all the *marks* by which things are remembered, being for the present choked up or disordered, the remembrance of those *objects* about which it is wont to employ itself, and even of the words (or other signs) in which it uses to reason, and to preserve the deductions and conclusions it makes, is all suspended at least for the time; and so its tables being covered, its books closed, and its tools locked up, the requisites for reasoning are wanting, and no subject offers itself to exercise its thoughts, it having yet had little or no opportunity to take in *higher objects* and more *refined matter* for contemplation. And, to conclude, if it be demanded, Why any one should imagine that the *soul* may think, perceive, act, *after death*, when it doth not do this in sleep, &c.? the answer is, Because those *inclosures* and *impediments* which occasioned the forementioned intermissions, and those great limitations under which it labours at all times, will be removed with its enlargement out of the body. When it shall in its *proper vehicle* be let go, and take its flight into the open fields of heaven, it will then be bare to the immediate impressions of objects: And why should not those impressions which affected the *nerves*, that moved and affected the vehicle and soul in it, *affect the vehicle immediately* when they are immediately made upon it, without the interposition of the nerves? The hand which feels an object at the end of a *staff*, may certainly be allowed to feel the same much better by *immediate contact* without the staff."

The opinion, that the soul is united to some fine vehicle, which dwells with it in the brain, and goes off with it at death, was not peculiar to Mr Wollaston. It was thought extremely probable by Dr Hartley, and shall be shown afterwards to have been a very ancient opinion; but we do not quote it at present as either well or ill founded, but only as sufficient, in conjunction with the reasoning of its author, to obviate the force of Dr Priestley's second illustration of his argument for the materiality of mind, provided the argument itself be not more powerful than any which the immaterialists can bring against it.

The Doctor's third illustration we have already obviated, when we accounted for the mind and the body mutually affecting each other; and we might refer to Dr Price's answer (E) to the fourth, as being, in our opinion, a full confutation of it. But as that author's notions of *mind* and *ideas* differ in some respects from our own, we shall examine this objection to the doctrine of the immaterialists upon principles which we believe Dr Priestley more inclined to admit.

That the sentient principle in man, if it be immaterial, can have no extension, is a truth which we think cannot be controverted; and if so, every thing in that principle must be *simple* and *indivisible*. Thus far we agree with Dr Priestley; but with respect to what follows we differ from him entirely. The agitation in the brain, which is the immediate cause of sensation, must indeed correspond to the impression *ab extra* by which it is produced, and therefore must have the property of extension; but that agitation, whatever it be, is not itself sensation any more than a bludgeon is a blow or a sword is a wound. Dr Priestley, indeed, in answer to Dr Price, affirms, that, according to Hartley's theory, ideas are only *vibrations in the brain;* but whoever shall take the trouble to examine that theory himself, will not find that its author ever advances such an opinion, or considers vibrations as any thing more than the instruments by which sensations and ideas are excited in the sentient principle. A real and proper idea, as we have often repeated, is nothing else than a fainter sensation: but no sensation, from whatever cause it may proceed, is itself extended; nor could we, without memory, the reasoning faculty, and the power of local motion, have acquired from mere sense any notion of extension at all:) See sect. 3. chap. 1. Part I.) Sensations and ideas are those *appearances* (if we may so say), which vibrations or some other motion in the brain excite in the mind; but a *half* appearance is an absurdity. A man may view *half a tree* with his eyes, and he may contemplate the idea of *half a tree* in his mind; but he cannot have *half a view* or *half an idea* of any thing. Sensations and ideas result from the mutual agency of the brain and sentient principle upon each other; and if the agency of the brain be vibration, more of it may vibrate at one time than at another: but surely the mere relation between its agency at any time and the agency of the mind, can neither have extension nor be divisible; for who ever thought of extending or dividing relations? On this subject it is extremely difficult to write with perspicuity and precision; and what we have said may very possibly be misunderstood. Our notion is to ourselves clear and determinate; but language which was not invented by metaphysicians, wants words in which it may be properly expressed. Perhaps the reader may understand what we mean, when we say that a sensation or an idea is the instantaneous effect of the mutual agency of the brain and sentient principle. Of this we think every man, by a little attention, may be perfectly convinced, though it may be impossible ever to discover the precise nature

(E) In *Disquisitions*, p. 37 and 102, it is asserted, that ideas are certainly divisible. "This seems to me very absurd. It would be as proper to assert ideas to be hard or round. The idea of an object is the apprehension, view, or notion of it; and how can this be divisible? Perception is a single and indivisible act. The object perceived may be divisible; but the *perception* of it by the mind cannot be so. It is said in page 95, *that if ideas are not things distinct from the mind, a mind with ideas and a mind without ideas would be the same.*—I maintain, that ideas are not distinct from the mind, but its conceptions; or not *things* themselves, but *notions* of things. How does it follow from hence, that a mind with or without ideas is the same? It would seem that this follows much more from the contrary assertion." *Correspondence between Dr Price and Dr Priestley.*

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ture of this agency; and if so, it is plain that sensations and ideas cannot be divided, for no instantaneous effect of any kind is divisible. A sensation, and of course a simple and original idea, neither has extension itself, nor suggests the notion of extension *ab extra*. By running the hand or any other member along a solid body, we feel continued resistance: this feeling, or the idea of this feeling, becomes in time so closely associated with all our sensations of touch and sight, that the one cannot be separated from the other; and these associations are what Dr Priestley calls *extended ideas*. Upon the whole then, we think it apparent, that our sensations, and the relicts of our sensations, are unextended and indivisible, (F); and that though they suggest to us the existence of extended things *ab extra*, the sentient being *may* be unextended and indivisible.

Having thus examined Dr Priestley's auxiliary arguments for the materiality of mind, we now proceed to consider his main and direct proof. To this, as we have observed, so able a reply has been made, that it would be injustice to our readers not to lay it before them, in the words of its author. "I readily acknowledge (says this spirited essayist*), that the power of sensation or perception never having been found but in conjunction with a certain organised system of matter, we ought, as philosophers, to conclude that this power necessarily exists in, and results from, that organised system, unless it can be shown to be incompatible with other known properties of the same substance. On the other hand it must be admitted, that constant conjunction implies *necessary* connection only when reasons cannot be discovered to prove the conjunction to be accidental and arbitary. In the present instance, it is alleged, that discerptibility is a property of matter absolutely incompatible with the property of sensation or perception; or in other words, that sensation is a power or property incapable of division. But as the power of the entire system is clearly nothing more than the sum or aggregate of the powers of all the parts, it necessarly follows, that the primary particles of which the system is composed must, upon the material hypothesis, possess distinct powers of sensation; and that those

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* Essays Philosophical, Historical, and Literary vol. ii.

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(F) We affirm this only of *human* sensations and ideas, because these are the only sensations and ideas of which we are conscious, and about which we can reason. Other animals are sentient as well as man, and appear to have their sensations excited by impressions *ab extra*; but whether in every species of animals a single impression excites but one sensation common to the whole animal, or different sensations which are felt each by a different faculty or sentient principle, is a question which we are not able to answer. We make this remark, because from the phenomena of sensation in the earth-worm, and other reptiles, some philosophers of eminence having supposed, that in these creatures the sentient faculty belongs to the material system, and is divisible with it; have thence concluded, we think rashly, that all arguments for the immateriality of the human mind are founded merely on our ignorance. We call this conclusion rash; because, though we know perfectly what a human sensation is, we have so little knowledge of the nature of sensation in worms, that what may be true of the one *principle* of sensation may be false of the other. Indeed, if we are to judge from the phenomena, this is actually the case. It appears from experiments made by Abbé Spallanzani and others, that if a certain number of rings be cut off either from the anterior or posterior part of a worm, or even from both, the remainder will not only continue to live and be sentient, but will also regenerate a new head and a new tail, and become again a complete worm. Nothing like this takes place in man or in the higher orders of animals; and therefore, were it certain that the sentient principle in the worm is diffused through the whole system and divisible with it, we could not infer that the principle of such sensations as we are conscious of, is likewise extended and divisible. It is, however, so far from being certain that the sentient principle is diffused through the whole worm, that nothing necessarily follows from this fact, but that its seat is at some distance from either extremity. Nay, were it true, as perhaps it is, that a worm may be so divided, as that each of the two sections shall retain life, sensation, and this reproductive power, we would not therefore be authorised to conclude that the sentient principle is *one*, co-extended and divisible with the material system. The earth-worm, like many other reptiles, being an hermaphrodite, which unites in itself both sexes, may possibly consist of two animated systems; which though united by some bond of connection, by which sensation is communicated from the one to the other, are yet in themselves perfectly distinct. Should this, upon proper investigation, be found to be the case; and should it likewise be found, that when a worm is divided into three or more parts, only one or two of these parts continue to live, there would be no room whatever for supposing that even in these creatures the principle of sensation is extended and divisible. In the mere power of reproducing amputated parts, when that power is considered by itself, there is nothing more wonderful than in the growing of the nails of our fingers or the hairs of our heads. The only thing which seems to militate against the simplicity of the principle of sensation in worms, is the continuance of life, &c. with both parts of a worm when cut into two by a knife or pair of scissars; but if a worm be found to have two seats of sensation analogous to the brain in higher animals, and if it be likewise found that life continues only in such sections as retain at least one seat of sensation, the sentient principle in the worm may be as simple and indivisible as in any animal whatever. We neither wish nor expect much stress to be laid upon these hints and conjectures. Should they induce any of our physiological readers, who have leisure, and are at the same time skilled in philosophy, properly so called, to institute a set of experiments upon worms, and such reptiles, and to trace apparent effects to their higher causes, they might eventually lead to important discoveries. In the mean time, it is sufficient for our purpose to observe, that whatever be the sentient principle or principles in the earth-worm, it is obvious that the whole animal cannot in any case be conscious as man undoubtedly is, of *one individual sensation*; and that therefore no arguments built upon the phenomena accompanying sensation in worms, can be of any importance in the controversy about the materiality or immateriality of the human mind.

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those powers combined constitute the indivisible power of sensation belonging to the system; or, in other words, that the *indivisible* power of sensation is a *divisible* power, nay, an infinitely divisible power, if matter be, as philosophers in general allow, an infinitely divisible substance—a conclusion obviously and grossly ridiculous. We are then compelled to acknowledge, that sensation or perception is not the property of a material substance; *i. e.* if the common mode of expression be retained, it is the property of an immaterial substance; or to avoid verbal contention, it is a property not resulting from, or necessarily connected with, the organical system, but a property wholly foreign, superinduced, and adventitious. (G)

"In opposition to this reasoning, the materialists affirm, that entire systems may possess, and they think themselves warranted to pronounce that organized systems of matter actually do possess, powers essentially different from those which inhere in the several parts. Amongst various familiar though striking illustrations of this truth, it has been said, that a rose possesses the property of sweetness or fragrance, a globe the property of sphericity, a harpsicord the property or power of producing harmony, *aqua regia* the property of dissolving gold, &c. though the component particles of these different organized systems are themselves totally destitute of the powers and properties here enumerated.

"The immaterialists, in reply, assert, that it is not only false in fact, but a direct contradiction, and an absolute impossibility in the nature of things, that a system should possess any property which does not inhere in its component parts. To assert that the power of the whole is the sum or aggregrate of the powers of all the parts, is an identical and self-evident proposition, the whole and all the parts being terms precisely synonymous. Whoever, therefore, calls in question the truth of this axiom, must maintain that the power of the whole is something different from the power of all the parts, *i. e.* that the power of the whole is *not* the power of the whole.

"It will be easy to demonstrate the correspondence of facts with this plain and simple theory. For this purpose, it is necessary to observe, that the properties of matter, or what are generally denominated such, may be divided into real and nominal, which Locke and others have called primary and secondary qualities. Figure, magnitude, and motion, are qualities really inherent in matter; but figure, magnitude, and motion, eternally varied, can produce only different combinations of figure, magnitude, and motion. There are also powers, or qualities, vulgarly considered as inherent properties of matter organically disposed, which are really and truly qualities or affections of the mental or percipient principle, and have no existence when not perceived. Thus the sweetness or fragrance of the rose, considered as mere sweetness and fragrance, can be nothing but an affection of the mind; considered as a quality of the rose, they can mean nothing more than a certain arrangement, configuration, and motion of parts, which in some inexplicable manner produces the sensation of sweetness. In this instance, therefore, the power of the whole is plainly the aggregate of the powers residing in the parts, by the motion and organization of which a certain effect is produced upon a foreign and percipient substance.

"But a globe, we are told, possesses the property of sphericity, though not a single particle amongst that infinite number of which the globe is constituted is itself of a spherical form. The fallacy of

(G) This argument is not new. It was long ago urged by Dr Clarke against Mr Dodwell; and some of our readers may not be ill pleased to see it stated by so masterly a reasoner: "That the soul cannot possibly be *material*, is demonstrable from the single consideration of bare sense or consciousness. For matter being a divisible substance, consisting always of separable, nay of actually separate and distinct parts, it is plain that unless it were essentially conscious, in which case every particle of matter must consist of innumerable separate and distinct consciousnesses, no system of it, in any possible composition or division, can be an individual conscious being. For suppose three or three hundred particles of matter, at a mile or any given distance one from another, is it possible that all these separate parts should in that state be one individual conscious being? Suppose then all these particles brought together into one system, so as to touch one another, will they thereby, or by any motion or composition whatsoever become one whit less truly distinct beings than they were when at the greatest distance How then can their being disposed in any possible system make them one individual conscious being? If you will suppose God by his infinite power superadding consciousness to the united particles, yet still these particles being really and necessarily as distinct beings as ever, cannot be *themselves* the *subject* in which that individual consciousness inheres; but the consciousness can only be superadded by the addition of something, which in all the particles must still itself be but one individual being. The soul, therefore, whose power of thinking is undeniably one individual consciousness, cannot possibly be a material substance." *Clarke's Letter to Mr Dodwell, 2d edition.*

That the same mode of reasoning was known to the ancients, Cudworth has shown by numerous quotations; and as an argument certainly loses nothing by antiquity, or by having occurred to thinking men in distant ages, we shall lay before our readers two passages from Plotinus, of which the extract from Clarke's letter (though we are persuaded it was not borrowed by the author) must be considered as little more than a paraphrastical translation. ——τι τοινυν φησουσιν, οι την ψυχην σωμα ειναι λεγοντες, πρωτον μεν περι εκαστου μερους της ψυχης της εν τω αυτω σωματι, ποτερον εκαστον ψυχην, οια εστι και η ολη; και παλιν του μερους το μερος; ουδεν αρα το μηκεθος συνεβαλλετο τη ουσια αυτης· καιτοι εδειγε ποσου τινος οντος· αλλα και ολον πολλα χη, οπερ σωματι παρειναι αδυνατον, εν πλειοσι το αυτο ολον ειναι, και το μερος ο περ το ολον, υπαρχειν· ει δε εκαστον των μερων, ου ψυχη φησουσιν, εξ αψυχων ψυχη αυτοις υπαρξει. *En.* IV. *Lib.* 7*timo. Cap.* 5.

The same argument is elsewhere stated thus: ει δε εκαστον ζωην εχοι, και εν αρκει· ει δε μηδενος αυτων ζωην εχοντος η συνοδος πεποιηκε ζωην, ατοπον· μαλλον δε αδυνατον συμφορησιν σωματων ζωην αγαζεθαι, νυν χωριν τα ανοικτα. *En.* IV. *Lib.* 7. *Cap.* 2.

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of this illustration is, however, as easily demonstrable as that of the former. The sphericity of a globe is evidently the sum or aggregate of the curvilinear or convex parts which compose its surface; and the property of the whole is neither more nor less than the combined properties of all its parts. No one doubts, that by new compositions or arrangement of material particles possessing magnitude, figure, and motion, an endless diversity of phenomena may be produced, to which it may be necessary to apply new names. New names, however, do not constitute new properties; and though we give to a globe the appellation of an entire system, and ascribe to it the property of sphericity, we know at the same time that it is really nothing more than a collection of thousands of millions of particles, actually separate and distinct, arranged in that particular form which we denominate spherical. But this can never be regarded as in the remotest manner analogous to the *creation* of the power of perception, in consequence of a certain organical arrangement or disposition of impercipient particles. Though sphericity is, indeed, the property of the entire sphere, yet every part of the sphere, if divided, possesses its share of sphericity. But if the percipient principle be divided, what would become of the power of perception? A sphere equally divided becomes two hemispheres; does a perception, when divided in like manner, become two demi-perceptions?

"The same reasonings may easily be transferred, and applied to the harpsichord. Can any one be absurd enough to affirm that the power of harmony resides in the harpsichord, as the power of perception does in the mind? After the utmost skill of the artificer has been exerted, we discover nothing more in the harpsichord than new modifications of the old properties of figure, magnitude, and motion, by means of which certain vibrations are communicated to the air, which conveyed by the medium of the auditory nerves to the sensorium, produce the sensation of harmonic sounds. These new modifications are therefore attended, indeed, with new and very wonderful effects; but then those effects are produced upon, and are themselves modifications of the sentient or percipient faculty. And though it is wholly incomprehensible to us in what manner these effects, that is, these *sensations*, are produced, we well know, and perfectly comprehend, that they are not new powers belonging to any organized system of matter; that they have no existence but in a mind perceiving them; and that they are far from militating against that grand and universal axiom, that the power of the whole is nothing more than the united powers of all the parts.

"As to the last instance adduced, of the power of *aqua regia* to dissolve gold, though neither the spirit of salt, nor the spirit of nitre of which it is compounded, separately possesses that power, it is plain, that from the union of these two substances, certain new modes of configuration and motion result; and the solution of gold is the consequence of this new arrangement and motion of the parts. But the particles of which the menstruum is composed were always possessed of the properties of figure and motion; and what is styled a new property, is clearly nothing more than a new effect of the old properties differently modified. In a word, the advocates for materialism may safely be challenged to produce, in the whole compass of nature, a case which bears the least analogy to that which these instances are most unphilosophically adduced to prove and to illustrate. It is an absurdity which transsubstantiation itself does not exceed, to maintain that a whole is in reality any thing different from its component parts; and all nature rises up in confutation of an assertion so monstrous and extravagant. To affirm that perception can arise from any combination of impercipient particles, is as truly ridiculous, as to affirm that a combination of the seven primary colours with the four cardinal virtues may constitute a planet. It is equivalent to an assertion, that an epic poem might be composed of parallelograms, cones, and triangles. In a word, it is an absurdity not less real, and little less obvious, than that of the blind man who thought that the idea of a scarlet colour resembled the sound of a trumpet."

236 Reply by the materialists shown

If matter be taken in the common acceptation, to be a solid, extended, and inert substance, this reasoning for the immateriality of the sentient principle in man appears to us to have the force of demonstration, which no difficulties or partial objections, arising from our inability to conceive the bond of union between two such heterogeneous substances as mind and body, can ever weaken, and far less overturn. But the modern materialists deny that matter is either solid or inert. "All those facts (say they) which led philosophers to suppose that matter is impenetrable to other matter, later and more accurate observations have shown to be owing to *something else* than solidity and impenetrability, viz. a *power of repulsion*, which for that reason they would substitute in its place. The property of *attraction* or repulsion (says Dr Priestley), appears to me not to be properly what is *imparted* to matter, but what really *makes it to be what it is*; insomuch, that without it, it would be nothing at all; and as other philosophers have said,—'Take away solidity, and matter vanishes,' so I say, 'Take away attraction and repulsion, and matter vanishes.' If this be admitted, the ingenious author hopes that we shall not consider matter with that contempt and disgust with which it has generally been treated, there being nothing in its real nature that can justify such sentiments respecting it.

237 to be absurd.

We know not why, upon any hypothesis, matter should be viewed with contempt and disgust.—Whether penetrable or impenetrable, every consistent theist considers it as one of the creatures of God perfectly fitted to answer all the purposes for which it was intended: but were it really destitute of solidity, and endowed with the powers of attraction and repulsion, we should still be obliged to consider it as incapable of the powers of sensation and thought. If we have any notion at all of what is meant by centres of attraction and repulsion (of which indeed we are far from being confident), it appears to us to be intuitively certain, that nothing can be the result of any possible combination of such centres, but new and more enlarged spheres of attraction and repulsion. But surely consciousness, sensation, and will, are as different from attraction and repulsion, as a cube is from the sound of a trumpet, or as the sensations of a felon in the agonies of death are from the attraction of the rope by which he is hanged. If this be admitted, and

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and we are persuaded it will be denied by no man whose understanding is not clouded by an undue attachment to paradoxes, the sentient principle cannot possibly be matter: for if, when the powers of attraction and repulsion are taken away, matter vanishes; and if consciousness and sensation are not attraction and repulsion; it is not more evident that three and two are not nine, than that the substance which attracts and repels cannot be that which is conscious and percipient.

238 Locke's opinion hasty and ill-founded,

Locke, who was certainly no materialist, as he repeatedly affirmed, and indeed demonstrated, that thought could never be the result of any combinations of figure, magnitude, and motion, was yet of opinion, that God by his almighty power might endow some systems of matter with the faculties of thinking and willing. It is always with reluctance that we controvert the opinions of so great a man; and it is with some degree of horror that we venture in any case to call in question the power of Omnipotence.—But Omnipotence itself cannot work contradictions; and it appears to us nothing short of a contradiction, to suppose the individual power of perception inhering in a system which is itself extended and made up of a number of separate and distinct substances. For let us suppose such a system to be six feet long, three feet broad, and two feet deep (and we may as well suppose a system of these dimensions to be percipient, as one that is smaller), then it is plain, that every idea must be extended, and that part of it must be in one place, and part in another. If so, the idea of a square inch will be six feet long, three feet broad, and two feet deep; and what is still harder to be digested, the several parts of this idea will be at a great distance from each other, without any bond of union among them. The being which apprehends one extremity of the idea, is, by the supposition, six feet distant from the being which apprehends the other extremity; and though these two distinct beings belong to one system, they are not only separable, but actually separated from each other as all the particles of matter are. What is it then that apprehends as *one* the whole of this extended idea? Part of it may be apprehended by one particle of matter, and part of it by another; but there is nothing which apprehends, or can apprehend, the whole. Perhaps it will be said, the power of apprehension is not divided into parts, but is the power of the one system, and therefore apprehends at once the whole idea. But a power or faculty cannot be separated from its subject, power which inheres in nothing being confessedly impossible; and a material system is not *one subject* in which any individual power or faculty can inhere. There must, therefore, be united to the system some *one* being, which is the subject of thought, and which is unextended as well as indivisible. This, we say follows undeniably. For, let us suppose, that an extended being without separable parts is possible, and that such a being is percipient; it is obvious, that the whole of any one of its perceptions could not be in one place. Now, though we should grant to Dr Priestley and other materialists, that every idea of an extended substance has itself three dimensions, and is incorporated and commensurate with the whole percipient system; what, upon this supposition, shall we think of consciousness and of the perception of truth? Is consciousness or truth extended? If so, one side or superficies of consciousness, or of a truth, may be greater or less than another, above or below, to the right or to the left; and it will be very proper and philosophical to speak of the length, breadth, and depth, of consciousness or of truth. But surely to talk of the place, or the extension of these things, is as absurd as to talk of the colour of sound, or the sound of a triangle; and we might as well say, that consciousness is green or red, as that it is an ell or an inch long; and that truth is blue, as that it has three dimensions.

239 because the sentient being cannot be extended.

This reasoning is somewhat differently stated by Cudworth; who observes, that if the soul be an extended substance, "it must of necessity be either a physical point (*i. e.* the least extension possible, if there be any such least extension), or else it must consist of more such physical points joined together. As for the former of these, it is impossible that *one single atom*, or *smallest point* of extension, should be able to perceive distinctly all the *variety* of things, *i. e.* take notice of all the *distinct* and *different* parts of an *extended object*, and have a *description* or *delineation* of the whole of them upon itself (for that would be to make it the least, and not the least, possible extension at the same time:) Besides, to suppose every soul to be but one *physical point*, or the smallest *possible extension*, is to suppose such an essential difference in matter or extension, as that some of the *points* thereof should be *naturally* devoid of all *life*, *sense*, and *understanding*; and others, again, naturally *sensitive* and *rational*. And even should this absurdity be admitted, it would yet be utterly inconceivable how there should be *one*, and *but* one, *sensitive* and *rational* atom in every man; how this atom of so *small* dimensions should actuate the whole system; and how it should constantly remain the same from infancy to old age, whilst all the other parts of the system transpire perpetually, and are succeeded by new matter (H).

"But if, according to the second hypothesis, souls be

(H) Should it be said, that this essential difference between the atoms of matter is not fortuitous; that some of them are created intelligent for the express purpose of animating systems of others which are unintelligent; and that these intelligent atoms do not operate upon the systems with which they are united, by the *vis inertiæ*, *solidity*, or *extension*, of matter, but by the energies of understanding and will: Should this (we say) be alleged, surely it may be asked, for what purpose they are conceived to have the quality of extension? It is evidently of no use; and it has been already shown, and shall be more fully shown afterwards, that by our notions of consciousness and understanding, we are so far from being led to suppose the subject of these powers extended, that we cannot suppose any relation whatever between them and extension. But if these intelligent atoms be divested of their quality of extension, they will be transformed from matter to mind, and become the very things for the existence of which we plead.

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be extended substances consisting of many points one without another, and all concurring in every sensation; then must every one of these points perceive either a *point* only of the object, or else the *whole*. Now, if every *point* of the *extended soul* perceives only a *point* of the *object*, then is there no *one thing* in us that perceives the whole, or that can compare one part of the object with another. On the other hand, if every *point* of the *extended soul* perceive the *whole object* at once, then would there be *innumerable perceptions* of the same object in every sensation; as many, indeed, as there are points in the extended soul—And from both these suppositions it would alike follow, that no man is *one single percipient* or person, but that in every man there are innumerable distinct *percipients* or *persons*; a conclusion directly contrary to the infallible evidence of consciousness (1)."

Cogent as these arguments for the immateriality of the sentient principle appear to be, they have been lately treated with the most sovereign contempt by a writer who professes to be a disciple of Dr Priestley's, but who seems not to have learned the modesty or the candor of his master. Dr Priestley labours to prove, that to account for the phenomena of perception and volition, &c. it is not necessary to suppose an immaterial principle in man. Mr Cooper with greater boldness affirms, and undertakes to demonstrate with all the parade of mathematical precision ‡, that such a principle is impossible. Though the authority of this philosopher in such inquiries as depend not immediately upon the retort and the furnace, is certainly not great, he yet utters his dogmas with such confidence, that it may not be improper to examine the chief arguments upon which they rest.

‡ Tracts Ethical, Theological, and Political, Vol. I.

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240 An attempt to prove the impossibility of immaterial substance

"Suppose (says he) the soul to have no common property with matter; then, nothing can act upon any other but by means of some common property. Of this we have not only all the proof that induction of known and acknowledged cases can furnish, but that additional proof also which arises from the impossibility of conceiving how the opposite proposition *can* be true. But by the supposition, the soul has no property in common with matter; and therefore the soul cannot act upon matter. But by the supposition of every system of immaterialism (except those of Malbranche, Berkeley, and Leibnitz), it is deemed an essential property of the soul, that it acts upon the body, or upon matter; therefore the soul can and cannot act upon matter at the same time, and in the same respect. But this is a contradiction in terms; and as two contradictions cannot both be true at the same time, the supposition of the existence of an immaterial soul cannot be true: that is, the soul does not exist."

241 shown to be futile.

This reasoning, the reader will observe, is carried on with all the pomp of mode and figure. The propositions hang upon each other like the several steps of an algebraic process: but as in such processes one error unwarily admitted produces a false result, so in demon-

(1) As the materialists endeavour to prejudice the public against the notion of an unextended soul, by representing it as a fiction of *Des Cartes*, altogether unknown to the ancients, it may not be improper to give our readers an opportunity of judging for themselves how far this representation is just—*Plotinus*, reasoning about the nature of the soul from its energies of sensation, expresses himself in these words:—*εἰτι μελλει αισθανεσθαι τινος, ἑν αυτο δει ειναι, και τω αυτω παντος αντιλαμβανεσθαι και ει δια πολλων αισθητηριον πλειω τα εισιοντα, η πολλαι περι ἑν ποιοτητες και δι ἑνος ποικιλον, οιον προσωπον· ου γαρ αλλο μεν ρινος αλλο δε οφθαλμων, αλλα ταυτον ὁμου παντων· και ει το μεν δι ομματων το δε δι ακοης, ἑν τι δει ειναι εις ὁ αμφω· η πως αν ειποι ὁτι ἑτερα ταυτα, μη εις το αυτο ὁμου των αισθησεων ελθον των.* "That which perceives in us, must of necessity be one thing, and by one and the same indivisible perceive all; and that whether they be more things entering through several organs of sense, as the many qualities of one substance, or one various and multiform thing, entering through the same organ, as the countenance and picture of a man. For it is not one thing in us that perceives the nose, and another thing the eyes, but it is one and the self-same thing that perceiveth all. And when one thing enters through the eyes, another through the ears, both these also must of necessity come at last to one indivisible; otherwise they could not be compared together, nor one of them be affirmed to be different from the other, the several ideas of them meeting no where in one place." Pursuing the same argument, and having observed, that if what perceiveth in us be extended, then one of these three things must of necessity be affirmed, that either every part of this extended soul perceives a part only of the object, or every part of it the whole object; or else, that all comes to some one point, which alone perceives both the several parts of the object aud the whole: he observes of the first of these suppositions, —*μεγεθει οντι τουτω, ξυμμεριζοιτο αν· ωστε αλλο αλλου μερος, και μηδενα ἡμων ὁλου του αισθητου α τιληψιν εχειν· ὡσπερ αν ει εγω μεν αλλου· συ δε αλλου αισθοιο*: "If the soul be a magnitude, then must it be divided, together with the sensible object, so that one part of the soul must perceive one part of the object, and another another; and nothing in it, the whole sensible; just as I should have the sense of one thing, and you of another." Of the second supposition, he writes in this manner: *ει δε ὁτιουν παντος αισθησεται· εις απειρα διαιρεισθαι του μεγεθους πεφυκοτος, απειρους και αισθησεις καθ εκαστον αισθητον συμβησεται γιγνεσθαι ἑκαστω ὁιον του αυτου απειρους εν τω ἐγεμονουντι ἡμων εικονος*: "But if every part of the extended soul perceive the whole sensible object, since magnitude is infinitely divisible, there must be in every man infinite sensations and images of one object."—And as for the third and last part of this disjunction, Plotinus by asserting the infinite divisibility of body, here shows that the supposition of any one physical point is in itself an absurdity. But if it were not, he agrees with Aristotle in asking *πως τω αμερει το μεριστον*·—thereby plainly indicating, that the sentient principle is totally separated from extension, and can neither be considered as extended like a superficies or solid, nor unextended as a physical point.

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demonstrative reasonings one unsound argument admitted into the premisses is necessarily productive of error in the conclusion. When the author affirms, "that nothing can act upon any other but by means of some common property," he affirms without the shadow of proof what is certainly not self-evident. He says, indeed, that of this we have all the proof that induction of known and acknowledged cases can furnish; but unless consciousness be calculated to deceive us, this is unquestionably a mistake. Matter, he repeatedly affirms, has no other properties than those of attraction and repulsion: but a man moves his arm by a mere energy of will; and therefore, according to this demonstrator, an energy of will must be either material attraction or material repulsion. If so, it is reasonable to conclude, that when a man draws his hand towards his head, the centre of his brain exerts its power of *attraction*; and that when he extends his arm at full length before him, the same centre exerts its power of *repulsion*. We beg pardon of our readers for detaining them one moment upon such absurdities as these: yet we cannot dismiss the argument without taking the liberty to ask our all-knowing author, How it comes to pass that the same centre sometimes attracts and sometimes repels the same substance at the same distance; nay, that it both attracts and repels substances of the same kind, at equal distances, and at the very same instant of time? This must be the case, when a man puts one hand to his head, and thrusts another from him; and therefore, if these operations be the effect of attraction and repulsion, it must be of attraction and repulsion, to which induction of known and acknowledged cases furnishes nothing similar or analogous, *i. e.* of such attraction and repulsion as, according to Mr Cooper's mode of reasoning, does not exist. The truth is, that we are not more certain that we ourselves exist, than that an energy of will is neither attraction nor repulsion, and therefore, unless all matter be endued with will, it is undeniable, that, whatever be the substance of the soul, one thing acts upon another by a property not common to them both. In what *manner* it thus acts, we pretend not to know: but our ignorance of the *manner* of any operation is no argument against the *reality* of the *operation itself*, when we have for it the evidence of consciousness and daily experience; and when the author shall have explained to general satisfaction how material centres attract and repel each other at a distance, we shall undertake to explain how one thing acts upon another with which it has no common properties.

242 A second attempt of the same kind

Suspicious, as it should seem, that this reasoning has not the complete force of mathematical demonstration, the author supports his opinion by other arguments. "Whatever we know, (says he), we know by means of its properties, nor do we in any case whatever certainly know any thing but these; and we infer in all cases the existence of any thing which we suppose to exist from the existence of its properties. In short, our idea of any thing is made up of a combination of our ideas of its properties. Gold is heavy, ductile, tenacious, opake, yellow, soluble in *aqua regia*, &c. Now, let any one suppose for an instant that gold is deprived of all these, and becomes neither heavy, ductile, tenacious, opake, yellow, soluble, &c. what remains, will it be gold? Certainly not. If it have other properties, it is another substance. If it have no properties remaining, it is nothing. For nothing is that which hath no properties. Therefore, if any thing lose all its properties, it becomes nothing; that is it loses its existence. Now, the existence of the soul is inferred, like the existence of every thing else, from its supposed properties, which are the phenomena of thinking, such as perception, recollection, judgment, and volition. But in all cases of *perfect* sleep, of the operation of a strong narcotic, of apoplexy, of swooning, of drowning where the vital powers are not extinguished, of the effects of a violent blow on the back part of the head, and all other leipothymic affections, there is neither perception, recollection, judgment, nor volition; that is, all the properties of the soul are gone, are extinguished. Therefore, the soul itself loses its existence for the time. If any man shall say that these properties are only *suspended* for the time, I would desire him to examine what idea he annexes to this suspension; whether it be not neither more nor less than that *they are made not to exist for the time*. Either no more is meant, or it is contradictory to matter of fact; and moreover, if more *be* meant, it may easily be perceived to involve the archetypal existence of abstract ideas, and to contradict the axiom, *impossibile est idem esse et non esse*."

243 shown to be equally weak.

For the benefit of short-sighted inquirers, it is to be wished that the author had favoured the public with this *proof* which might have been so easily brought; for we can discern no connection whatever between the suspension of the exercise of the powers of the mind, and the archetypal existence of abstract ideas, or the absurd proposition that it is *possible for the same thing to be and not be*. We think, however, that we understand enough of this reasoning which he has given us to be able to pronounce with some confidence that it is nothing to the purpose. For, in the *first* place, we beg leave to observe, that between the properties of gold and the powers of thinking, &c. there is no similarity; and that what may be true when affirmed of the one, may be false when affirmed of the other. The powers of the mind are all more or less active; the enumerated properties of gold are all passive. We know by the most complete of all evidence, that the exercise of power *may be* suspended, and the power itself remain unimpaired; but to talk of the suspension of the energies of what was never energetic, if it be not to contradict the axiom *impossibile est idem esse et non esse*, is certainly to employ words which have no meaning. Yet even this argument from the properties of gold might have led the author to suspect that something else may be meant by the suspension of the exercise of powers, than that *those powers are made not to exist for the time*. In a room perfectly dark gold is not yellow; but does it lose any of its essential properties, and become a different substance, merely by being carried from light to darkness? Is a man while in a dark room deprived of the faculty of sight, and one of the powers of his mind made not to exist for the time? The author will not affirm that either of these events takes place. He will tell us that gold exhibits not its yellow appearance, merely because the proper medium of light passes not from it to the eye of the percipient, and that it is only for want of the same medium that nothing is seen by us in perfect darkness. Here, then,

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then, by his own confession, is a power of the mind, and a property of an external object, both suspended in their energies, without being annihilated: and no proof has yet been brought that all the powers of the mind may not in the same manner be suspended in their energies without being made not to exist. As light is necessary to vision, but is not itself either the thing which sees or the thing which is seen; so may the brain be necessary to the phenomena of thinking, without being either that which thinks, or that which is thought upon: and as actual vision ceases when light is withdrawn, though the eye and the object both continue to exist; so may the *energy* of thinking cease when the brain is rendered unfit for its usual office, though the being which thinks, and the power of thought, continue to exist, and to exist unimpaired. That this is actually the case every man must be convinced who believes that in thinking he exerts the same powers to-day that he exerted yesterday; and therefore our author's second demonstration of the non-existence of mind is like his first, founded upon assertions which cannot be granted.

244 A third attempt of the same kind

Another of these pretended demonstrations is as follows: "If the soul exist at all, it must exist somewhere; for it is impossible to frame to one's self an idea of any thing existing, which exists no where. But if the soul exist somewhere, by the terms it occupies space, and therefore is extended; but whatever has extension, has figure in consequence thereof. The soul then, if it exist, hath the properties of extension and figure in common with matter. Moreover, by the supposition of every immaterial hypothesis (except those of Malbranche, Berkeley, and Leibnitz), it acts upon body, *i. e.* upon matter; that is, it attracts and repels, and is attracted and repelled, for there is no conceivable affection of matter but what is founded on its properties of attraction and repulsion; and if it be attracted and repelled, its re-action must be attraction and repulsion. The soul then has the properties of extension, figure, attraction, and repulsion, or solidity. But these comprise every property which matter, as such, has ever been supposed to possess. Therefore the soul is matter, or material. But by the supposition it is immaterial; therefore it does not exist. For nothing can exist whose existence implies a contradiction."

245 shown to confute itself.

Mr Cooper, we see, still proceeds in the direct road of mathematical demonstration; but in the present instance we beg leave to stop him in the very beginning of his course, and to ask *where* the universe exists? When he shall have given such an answer to this question as men of common sense may be able to comprehend, we may perhaps attempt to tell him where an unextended soul exists. If this demonstration be not a collection of words without meaning, the existence of space as a real thing is taken for granted. Space, therefore, has extension, and of course figure; but we believe Mr Cooper will find some difficulty in ascertaining the figure of infinite space. The mind certainly acts upon body. For this we have the evidence of consciousness and experience; but we have no evidence whatever that it must therefore attract and repel, and be attracted and repelled. It has been already observed, that the mind, whatever be its substance, acts upon the body by energies of will. What these are every man knows with the utmost certainty and precision, whilst we may venture to assert that no man knows precisely what corpuscular attraction and repulsion are, supposing the existence of such powers to be possible. When we speak of attraction and repulsion, we have some obscure notion of bodies acting upon each other at a distance; and this is all that we know of the matter. But when we think of an energy of the human will, the idea of distance neither enters nor can enter into our notion of such an energy. These are facts which we pretend not to prove by a mathematical or a chemical process. Every man must be convinced of their truth by evidence more complete than any proof, *viz.* immediate consciousness of his own thoughts and volitions. This being the case, we may turn Mr Cooper's artillery against himself, and, because mind acts upon body by powers different from attraction and repulsion, argue that body neither attracts nor repels; and were it true, as it is certainly false, that nothing could act upon another but by means of some property common to both, we might infer that every atom of matter is endowed with the powers of volition and intelligence, and by consequence that every man is not one but ten thousand conscious beings, a conclusion which our philosopher seems not inclined to admit.

246 Objections to the doctrine of immaterialism stated and answered.

Having finished his *demonstrations*, the author states other objections to the doctrine of immaterialism, which as they are not his own nor new, have greater weight. "It appears no more than reasonable (says he), that if the doctrine of materialism be rejected as inadequate to explain the phenomena, these latter should at least be explained in some manner or other better upon the *substituted* than the *rejected* hypothesis; so that it is reasonable to require of an immaterialist that his supposition of a distinct soul should explain the *rationale* of the phenomena of thinking. But, strange to say, so far from attempting to explain these phenomena on the immaterial hypothesis, it is acknowledged on all hands that even on this hypothesis the phenomena are inexplicable." This objection it would certainly be no difficult task to obviate; but from that trouble, small as it is, we are happily exempted by the objector. "I would have it understood (says he), that no materialist ever undertook to say *how* perception results from our organization. What a materialist undertakes to assert is, that perception, *whatever* it be, or *however* it results from, does actually result from our organization." According to Mr Cooper, then, the *rationale* of thinking is equally inexplicable by materialists and immaterialists; and the truth is, that we know the *rationale* of hardly any one operation in nature. We see that the stroke of a racket produces motion in a biliard ball; but how it does so, we believe no man can say. Of the fact, however, we are certain; and know that the motion is produced by some power, about the effects of which we can reason with precision. In like manner we know with the utmost certainty, that we ourselves have the powers of perception and volition; and that these powers cannot be conceived as either an ell or an inch long. How they result from the mutual agency of an immaterial and material substance upon each other, we are indeed profoundly ignorant; but that such is the fact, and that they are not the result of mere organization, we must necessarily believe, so long as it is true that the power of the entire system is nothing more than the

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the sum or aggregate of the powers of all its parts. The immaterial hypothesis contains in it something inexplicable by man: The material hypothesis likewise contains, by the confession of its advocates, something that is equally inexplicable; and is over and above burdened with this contradiction, that the whole is something different from all its parts. It is therefore *no* "singular phenomenon in literary history, that one hypothesis should be rejected as indequate to account for appearances, and that the hypothesis substituted should, even by the acknowledgement of its abettors, be such as not only not to explain the *rationale* of the appearances, but, from the nature of it, to preclude all hopes of such an explanation." This is exactly the case with respect to a *vacuum* in astronomy. That hypothesis does not in the least tend to explain the rationale of the motions of the planets; but yet it must be admitted in preference to a *plenum*, because upon this last hypothesis motion is impossible.

247 Whether as many things may be asserted of the soul as of the body.

"Supposing the existence of the soul, it is an unfortunate circumstance (says Mr Cooper), that we cannot properly assert positively any thing of it at all." Were this the case, it would indeed be a very unfortunate circumstance; but can we not assert positively as many things of the soul as we can of the body? Can we not say with as much propriety and certainty, that the soul has the powers of perception and volition, &c. as that the body is solid and extended, or as that matter has the powers of attraction and repulsion? We know perfectly what perception and volition are, though we cannot have *ideas* or mental images of them; and if our author knows what attraction and repulsion are, we believe he will not pretend to have of them ideas entirely abstracted from their objects. "But granting the soul's existence, it may be asked (says he), Of what use is an hypothesis of which no more can be asserted than its existence?" We have just observed, that much more can be asserted of the soul than its existence, viz. that it is something of which perception and will are properties; and he himself asserts nothing of matter but that it is something of which attraction and repulsion are properties.

"This soul, of which these gentlemen (the immaterialists) are conscious, is immaterial essentially. Now, I deny (says our author), that we can have any idea at all of a substance purely immaterial." He elsewhere says, that nothing can exist which is not extended, or that extension is inseparable from our notions of existence. Taking the word *idea* in its proper sense, to denote that appearance which external objects make in the imagination, it is certainly true that we can have no *idea* of an immaterial substance; but neither have we, in that sense, any idea of matter abstracted from its qualities. Has Mr Cooper any *idea* of that which attracts and repels, or of attraction and repulsion, abstracted from their objects? He may, perhaps, have, though we have not, very adequate ideas of bodies acting upon each other at a distance; but as he takes the liberty to substitute assertions for arguments, we beg leave in our turn to assert, that those ideas neither are, nor can be, more clear and adequate than our notion of perception, consciousness, and will, united in one being.

That extension is no otherwise inseparable from our notions of existence than by the power of an early and perpetual association, is evident from this circumstance, that, had we never possessed the senses of sight and touch, we never could have acquired any idea at all of extension. No man, who has thought on the subject, will venture to affirm, that it is absolutely impossible for an intelligent being to exist with no other senses than those of smell, taste, and hearing. Now it is obvious that such a being must acquire some notion of existence from his own consciousness: but into that notion extension could not possibly enter; for neither sounds, tastes, smells, nor consciousness, are extended; and it is a fundamental article of the materialists creed, that all our ideas are relicts of sensation. Since then existence may be conceived without extension, it may be inferred that they are not inseparable from each other; and since cogitation cannot be conceived with extension, we may reasonably conclude that the being which thinks is not extended.

248 Extension not inseparable from all notions of existence.

Mr Cooper indeed with his master talks of extended ideas and extended thoughts: but we must assert, in the words of Cudworth, that "we cannot conceive a *thought* to be of such a certain *length*, *breadth*, and *thickness*, measurable by *inches*, *feet*, and *yards*; that we cannot conceive the *half*, or *third*, or *twentieth* part of a thought; and that we cannot conceive every thought to be of some determinate *figure*, such as *round* or *angular*, *spherical*, *cubical*, *cylindrical*, or the like. Whereas if extension were inseparable from existence, *thoughts* must either be mere *non-entities*, or extended into *length*, *breadth*, and *thickness*; and consequently all truths in us (being nothing but complex thoughts) must be long, broad, and thick, and of some determinate figure. The same must likewise be affirmed of volitions, appetites, and passions, and of all other things belonging to cogitative beings; such as knowledge and ignorance, wisdom and folly, virtue and vice, &c. that these are either all of them absolute *non-entities*, or else extended into three dimensions, and measurable not only by *inches* and *feet*, but also by solid measures, such as *pints* and *quarts*. But if this be absurd, and if these things belonging to soul and mind (though doubtless as great realities at least as the things which belong to body) be *unextended*, then must the substances of souls or minds be themselves unextended, according to that of Plotinus, Νους ου διαστας αφ εαυτου, and therefore the human soul cannot be material."

249 That the human mind cannot exert its faculties but in union with some corporeal system, an opinion probable and

Mr Cooper employs many other arguments to prove the materiality of the sentient principle in man; but the force of them extends no farther than to make it in the highest degree probable, that the mind cannot exert its faculties but in union with some organised corporeal system. This is an opinion which we feel not ourselves inclined to controvert; and therefore we shall not make any particular remarks upon that part of our author's reasonings. That an immaterial and indiscerptible being, such as the soul, is not liable to be *dissolved* with the body, is a fact which cannot be controverted: for what has no parts can perish only by *annihilation*; and of annihilation the annals of the world afford no instance. That an immaterial being, endowed with the powers of perception and volition, &c. *may be capable* of exerting these powers in a state of separation from all body? and that at least one immaterial Being does actually so exert them, or other powers analogous to them, are truths which no man whose

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whose arrogance does not surpass his judgment will venture to deny; but the question at present between the most rigid immaterialists and their opponents, is, whether there is ground to think that the human soul is such a being?

Now, when Mr Baxter and his followers confidently affirm, that human perception must *necessarily* subsist after the dissolution of the present mortal and perishable system; and that the soul, when disencumbered of *all body*, will have its faculties greatly *enlarged;* they affirm what to us appears incapable of proof. That a disembodied soul *may* perceive and think, and act, and that its powers of intellection *may* have a wider range than when they were circumscribed by a corporeal system, which permitted their action upon external objects only through five organs of sense, is certainly *possible;* and the argument by which the materialists pretend to prove it *not* possible, is one of the most contemptible sophisms that ever disgraced the page of philosophy. To affirm, that because our intellectual powers, in their embodied state, seem to decay with the system to which they are united, the mind, when set free, must therefore have no such powers at all, is equally absurd as to say, that because a man shut up in a room which has but one window sees objects less and less distinctly as the glass becomes more and more dimmed, he must in the open air be deprived of the power of vision. But because the human soul *may*, for any thing that we see to the contrary, subsist, and think, and act, in a separate state, it does not therefore necessarily follow that it *will* do so; and every thing that we know of its nature and its energies leads us to think, that without some kind of body by which to act as by an instrument, all its powers would continue dormant. There is not the shadow of a reason to suppose that it existed and was conscious in a prior state; and as its memory at present unquestionably depends upon the state of the brain, there is all the evidence of which the case will admit, that if it should subsist in a future state divested of all body, though it might be endowed with new and enlarged powers of *perception*, it could have no *recollection* of what it did and suffered in *this world*, and therefore would not be a fit object either of reward or of punishment. This consideration has compelled many thinking men, both Pagans and Christians, to suppose that at death the soul carries with it a fine material vehicle, which is its immediate sensorium in this world, and continues to be the seat of its recollection in the next. Such, we have seen, was the opinion of Mr Wollaston and Dr Hartley; it was likewise the opinion of Cudworth and Locke, who held that the supreme Being alone is the only mind wholly separated from matter; and it is an opinion which even Dr Clarke, one of the ablest advocates for immaterialism, would not venture positively to deny.

250 Ancient.

Nor is this opinion peculiar to a few moderns. Cudworth, after giving a vast number of quotations from Pythagoreans and Platonists, which prove to a demonstration that they held the Deity to be the only mind which perceives and acts without the instrumentality of matter, observes, that "from what hath been said, it appeareth, that the most ancient assertors of the incorporeity and immortality of the human soul, yet supposed it to be always conjoined with some body. Thus *Hierocles* plainly ἡ λογικη ουσια συμφυες εχουσα σωμα ουτω παρα του δημιουργου εις το ειναι παρηλθεν, ως μητε το σωμα ειναι αυτην, μητε ανευ σωματος· αλλ αυτην μεν ασωματον, αποπερα τουσθαι δι εις σωμα το ολον αυτης ειδος. *The rational nature having always a kindred body, so proceeded from the demiurgus, as that neither itself is body, nor yet can it be without body; but though itself be incorporeal, yet its whole form is terminated in a body.* Agreeably to this the definition which he gives of a man is, ψυχη λογικη μετα συμφους αθανατου σωματος, *a rational soul, together with a kindred immortal body;* and he affirms, that our present animated terrestrial body, or mortal man, is nothing but ειδωλον ανθρωπου, *the image of the true man*, or an accession from which it may be separated. Neither does he affirm this only of human souls, but also of all other rational beings whatsoever below the supreme Deity, that they always naturally actuate some body. Wherefore a demon or angel (which by *Hierocles* are used as synonymous words), is also defined by him after the same manner, ψυχη λογικη μετα φωτειδους σωματος *a rational soul, together with a lucid body.* And accordingly *Proclus* upon *Plato's Timæus affirmeth*, παντα δαιμονα των ημετερων κρειττονα ψυχων, και νοεραν εχειν ψυχην, και οχημα αιθριον: *That every demon, superior to human souls, hath both an intellectual soul and an ætherial vehicle, the entireness thereof being made up or compounded of these two things.* So that there is hardly any other difference left between demons or angels, and men according to these philosophers, but only this, that the former are lapsable into aerial bodies only, and no further; but the latter into terrestrial also. Now, *Hierocles* positively affirms this to have been the true cabala, and genuine doctrine of the ancient Pythagoreans, entertained afterwards by Plato: και τουτο των Πυθαγορειων ην δογμα, ὁ δε Πλατων υστερον εξεφηνεν, απεικατας ξυμφυτω δυναμει υποπτερου ξευγους τε και ηνιοχου; πασαν θειαν τε και ανθρωπινην ψυχην. *And this was the doctrine of the Pythagoreans, which Plato afterwards declared; he resembling every both human and divine soul* (i. e. in our modern language, every created rational being) *to a winged chariot, and a driver or charioteer both together:* meaning by the chariot, an animated body; and by the charioteer, the incorporeal soul actuating it.

That this Pythagorean opinion of the Deity's being the only mind which thinks and acts without material organs was very generally received by the ancient Christians, might be proved by a thousand quotations: We shall content ourselves with producing two from the learned *Origen*. "Solius Dei (saith this philosophic father of the Church), id est, Patris, Filii, et Spiritus Sancti, naturæ id proprium est, ut sine materiali substantia, et absque ulla corporeæ adjectionis societate, intelligatur subsistere †." "Materialem substantiam opinione quidem et intellectu solum separari, a naturis rationalibus, et pro ipsis, vel post ipsis affectam videri; sed nunquam sine ipsa eas vel vixisse, vel vivere: Solius namque Trinitatis incorporea vita existere putabitur ‡." Should Mr Cooper and his friends ask, What is the use of a soul which cannot act without the instrumentality of matter? or why we should suppose the existence of such a substance? we beg leave, in our turn, to ask these gentlemen, What is the use of a brain which cannot see without eyes? and

† Peri Archon, lib. 1. cap. 6.

‡ Lib. 2. cap. 2.

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and why they ſhould ſuppoſe all our ſenſations to terminate in ſuch an internal ſyſtem, ſince the vulgar certainly ſuppoſe their ſenſations to ſubſiſt in their reſpective organs? How this ancient notion, which makes body ſo eſſential a part of man, is conſiſtent with the immortality of the human ſoul, we ſhall inquire in a ſubſequent chapter; in which we ſhall endeavour to aſcertain what kind of immortality we have reaſon to expect, and upon what evidence our expectation muſt reſt. Previous to this inquiry, however, it is neceſſary to enter upon another, which is of the firſt importance, and which every materialiſt has endeavoured to perplex; we mean that which concerns *perſonal identity*: for if, as has been often ſaid, no man is the ſame perſon two days ſucceſſively, it is of no importance to us whether the ſoul be mortal or immortal.

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251 Perſonal identity,

Whether we are to live in a future ſtate, as it is the moſt important queſtion which can poſſibly be aſked, ſo is it the moſt intelligible one which can be expreſſed in language. Yet ſtrange perplexities have been raiſed about the meaning of that identity or ſameneſs of perſon, which is implied in the notion of our living now and hereafter, or indeed in any two ſucceſſive moments; and the ſolution of theſe difficulties hath been ſtranger than the difficulties themſelves. To repeat all that has been ſaid on the ſubject would ſwell this chapter to a diſproportionate bulk. We ſhall therefore content ourſelves with laying before our readers the ſentiments of Biſhop Butler, and the fancies and demonſtrations of the philoſopher of Mancheſter. We are induced to adopt this courſe, becauſe we think the illuſtrious Biſhop of Durham has exhauſted the ſubject, by ſtating fairly the opinions which he controverts, and by eſtabliſhing his own upon a foundation which cannot be ſhaken, and which are certainly not injured, by the objections of Mr Cooper.

252 though it cannot be defined, eaſily underſtood and aſcertained by conſciouſneſs and memory.

† Diſſertation 1ſt, ſubjoined to the Analogy of Religion, &c.

"When it is aſked (ſays this philoſophical prelate†) in what perſonal identity conſiſts? the anſwer ſhould be the ſame as if it were aſked in what conſiſts ſimilitude or equality?—that all attempts to define would but perplex it. Yet there is no difficulty at all in aſcertaining the idea or notion: For as, upon two triangles being compared or viewed together, there ariſes to the mind the notion of ſimilitude; or, upon twice two and four, the notion of equality: ſo likewiſe, upon comparing the conſciouſneſs of one's ſelf or one's own exiſtence in any two moments, there as immediately ariſes to the mind the notion of perſonal identity. And as the two former compariſons not only give us the notions of ſimilitude and equality, but alſo ſhow us that two triangles are ſimilar, and that twice two and four are equal; ſo the latter compariſon not only gives us the notion of perſonal identity, but alſo ſhows us the identity of ourſelves in theſe two moments—the preſent, ſuppoſe, and that immediately paſt, or the preſent and that a month, a year, or twenty years paſt. In other words, by reflecting upon that which is myſelf now, and that which was myſelf twenty years ago, I diſcern they are not two, but one and the ſame ſelf.

"But though conſciouſneſs of what is preſent and remembrance of what is paſt do thus aſcertain our perſonal identity to ourſelves; yet, to ſay that remembrance makes perſonal identity, or is neceſſary to our being the ſame perſons, is to ſay that a perſon has not exiſted a ſingle moment, nor done one action, but what he can remember; indeed none but what he reflects upon. And one ſhould really think it ſelf-evident, that conſciouſneſs of perſonal identity preſuppoſes and therefore cannot conſtitute perſonal identity; any more than knowledge, in any other caſe, can conſtitute truth, which it preſuppoſes.

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253 Theſe, however, do not make perſonal identity.

"The inquiry, what makes vegetables the ſame in the common acceptation of the word, does not appear to have any relation to this of perſonal identity; becauſe the word *ſame*, when applied to them and to perſon, is not only applied to different ſubjects, but is alſo uſed in different ſenſes. When a man ſwears to the ſame tree, as having ſtood fifty years in the ſame place, he means only the ſame as to all the purpoſes of property and uſes of common life, and not that the tree has been all that time the ſame in the ſtrict philoſophical ſenſe of the word: For he does not know whether any one particle of the preſent tree be the ſame with any one particle of the tree which ſtood in the ſame place fifty years ago. And if they have not one common particle of matter, they cannot be the ſame tree in the proper and philoſophic ſenſe of the word *ſame*; it being evidently a contradiction in terms to ſay they are, when no part of their ſubſtance and no one of their properties is the ſame; no part of their ſubſtance, by the ſuppoſition; no one of their properties, becauſe it is allowed that the ſame property cannot be transferred from one ſubſtance to another: And therefore, when we ſay that the identity of ſameneſs of a plant conſiſts in a continuation of the ſame life, communicated under the ſame organization to a number of particles of matter, whether the ſame or not; the word *ſame*, when applied to life and to organiſation, cannot poſſibly be underſtood to ſignify what it ſignifies in this very ſentence, when applied to matter. In a looſe and popular ſenſe, then, the life, and the organiſation, and the plant, are juſtly ſaid to be the ſame, notwithſtanding the perpetual change of the parts. But, in a ſtrict and philoſophical manner of ſpeech, no man, no being, no mode of being, no any thing, can be the ſame with that with which it has indeed nothing the ſame. Now ſameneſs is uſed in this latter ſenſe when applied to perſons. The identity of theſe, therefore, cannot ſubſiſt with diverſity of ſubſtance.

254 What it is.

"The thing here conſidered, and demonſtratively, as I think, determined, is propoſed by Mr Locke in theſe words: *Whether it* (i. e. the ſame ſelf or perſon) *be the ſame identical ſubſtance?* And he has ſuggeſted what is a much better anſwer to the queſtion than that which he gives it in form: For he defines perſon *a thinking intelligent being*, &c. and perſonal identity, *the ſameneſs of a rational being*; and then the queſtion is, Whether the ſame rational being is the ſame ſubſtance? which needs no anſwer; becauſe being and ſubſtance are in this place ſynonymous terms. The ground of the doubt, whether the ſame perſon be the ſame ſubſtance, is ſaid to be this, that the conſciouſneſs of our own exiſtence, in youth and in old age, or in any two joint ſucceſſive moments, is not *the ſame individual action*,

i. e.

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i. e. not the same consciousness, but different successive consciousnesses. Now it is strange that this should have occasioned such perplexities: for it is surely conceivable, that a person may have a capacity of knowing some object or other to be the same now which it was when he contemplated it formerly; yet in this case, where, by the supposition, the object is perceived to be the same, the perception of it in any two moments cannot be one and the same perception. And thus, though the successive consciousnesses which we have of our own existence are not the same, yet are they consciousnesses of one and the same thing or object; of the same person, self, or living agent. The person of whose existence the consciousness is felt now, and was felt an hour or a year ago, is discerned to be, not two persons, but one and the same person; and therefore is one and the same.

255 False notions of personal identity

"Mr Locke's observations upon this subject appear hasty; and he seems to profess himself dissatisfied with suppositions which he has made relating to it. But some of those hasty observations have been carried to a strange length by others; whose notion, when traced and examined to the bottom, amounts, I think, to this: "That personality is not a permanent but a transient thing: That it lives and dies, begins and ends, continually: That no one can any more remain one and the same person two moments together, than two successive moments can be one and the same moment: That our substance is indeed continually changing: but whether this be so or not is, it seems, nothing to the purpose; since it is not substance, but consciousness, alone, which constitutes personality; which consciousness, being successive, cannot be the same in any two moments, nor consequently the personality constituted by it §." Hence it must follow, that it is a fallacy upon ourselves to charge our present selves with any thing we did, or to imagine our present selves interested in any thing which befel us, yesterday; or that our present self will be interested in what will befal us to-morrow; since our present self is not in reality the same with the self of yesterday, but another self or person coming in its room, and mistaken for it; to which another self will succeed to-morrow. This, I say, must follow: for if the self or person of to-day and that of to-morrow are not the same, but only like persons; the person of to-day is really no more interested in what will befal the person of to-morrow, than in what will befal any other person. It may be thought, perhaps, that this is not a just representation of the opinion we are speaking of; because those who maintain it allow that a person is the same as far back as his remembrance reaches: And indeed they do use the words *identity* and *same* person; nor will language permit these words to be laid aside. But they cannot, consistently with themselves, mean that the person is really the same: for it is self-evident, that the personality cannot be really the same, if, as they expressly assert, that in which it consists is not the same. And as, consistently with themselves, they cannot, so I think it appears they do not, mean that the person is *really* the same, but only that he is so in a fictitious sense, in such a sense only as they assert: for this they do assert, that any number of persons whatever may be the same person. The bare unfolding this notion, and laying it thus naked and open, seems the best confutation of it. However, since great stress is said to be put upon it, I add the followings things:

§ Answer to Dr Clarke's third Defence of his Letter to Mr Dodwell, second edit. p. 44, 56, &c.

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256 Overthrown.

"*First*, The notion is absolutely contradictory to that certain conviction, which necessarily and every moment rises within us, when we turn our thoughts upon ourselves, when we reflect upon what is past, and look forward to what is to come. All imagination, of a daily change of that living agent which each man calls himself for another, or of any such change throughout our whole present life, is entirely borne down by our natural sense of things. Nor is it possible for a person in his wits to alter his conduct with regard to his health or affairs, from a suspicion that though he should live to-morrow he should not however be the same person he is to day.

"*Secondly*, It is not an *idea*, or abstract *notion*, or quality, but a being only which is capable of life and action, of happiness and misery. Now all beings confessedly continue the same during the whole time of their existence. Consider then a living being now existing, and which has existed for any time alive: this living being must have done, and suffered, and enjoyed, what it has done, and suffered, and enjoyed, formerly (this living being, I say, and not another), as really as it does, and suffers, and enjoys, what it does, and suffers, and enjoys, this instant. All these successive actions, sufferings, and enjoyments, are actions, enjoyments, and sufferings, of the same living being; and they are so prior to all considerations of its remembering or forgetting, since remembering or forgetting can make no alteration in the truth of past matter of fact. And suppose this being endued with limited powers of knowledge and memory, there is no more difficulty in conceiving it to have a power of knowing itself to be the same being which it was some time ago, of remembering some of its actions, sufferings, and enjoyments, and forgetting others, than in conceiving it to know, or remember, or forget, any thing else.

"*Thirdly*, Every person is conscious that he is now the same person or self he was as far back as his remembrance reaches: since when any one reflects upon a past action of his own, he is just as certain of the person who did that action, namely himself (the person who now reflects upon it), as he is certain that the action was at all done. Nay, very often a person's assurance of an action having been done, of which he is absolutely assured, arises wholly from the consciousness that he himself did it: and this he, person, or self, must either be a substance or the property of some substance. If *he*, if person, be a substance; then consciousness that he is the same person, is consciousness that he is the same substance. If the person, or *he*, be the property of a substance, still consciousness that he is the same property is as certain a proof that his substance remains the same, as consciousness that he remains the same substance would be; since the same property cannot be transferred from one substance to another.

"But though we are thus certain that we are the same agents, living beings, or substances, now, which we were as far back as our remembrance reaches; yet it is asked, Whether we may not possibly be deceived in it? And this question may be asked at the end of any demonstration whatever; because it is a question con-

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concerning the truth of perception by memory: and he who can doubt whether perception by memory can in this case be depended upon, may doubt also whether perception by deduction and reasoning, which also include memory, or indeed whether intuitive perception itself, can be depended upon. Here then we can go no farther: for it is ridiculous to attempt to prove the truth of our faculties, which can no otherwise be proved than by the use or means of those suspected faculties themselves."

257 Objections to the foregoing reasoning. * Tracts, &c.

This reasoning, which we believe will to most men appear unanswerable, Mr Cooper hopes to overturn by the following observations *: "If all imagination of a daily change in us be borne down by our natural sense of things, then (says he) does our natural sense of things positively contradict known fact; for a daily, a momentaneous change in us, *i. e.* in our bodies, does actually take place." True, a daily change in our bodies does take place, and so likewise does a daily change in our cloaths; but surely no man was ever led by his natural sense of things to suppose, that his limbs or external organs were the seats of sensation and will, any more than that his coat or his shoes were any real parts of his trunk or of his feet. But it is only that which thinks and wills that any man considers, in this case, as himself or his person; and if our natural sense of things, or consciousness, tells us, that what thinks and wills has continued the same from a distance of time as far back as we can remember, it is certain, that, whether it be material or immaterial, it has continued from that period, otherwise we can be certain of nothing. "But (says our philosopher) other known and ascertained facts are frequently borne down by our natural sense of things: for how many thousand years before the days of *Copernicus* was the motion of the earth round the sun entirely borne down by our natural sense of things which made us give full credit to the motion of the sun round the earth? Do not the generality of mankind believe, upon the evidence of their natural sense of things, that every part of their body remains exactly the same to-day as it was yesterday?"

258 Answered.

To the former of these questions we answer positively, that before the days of *Copernicus* the motion of the earth round the sun was *not* borne down by our *natural sense* of things, but by ill-founded hypotheses and inconclusive reasonings. By the natural sense of things, nothing can be meant, in this place, but the evidence of consciousness or of external sensation; but the *actual motion* either of the sun or of the earth is not perceived either by consciousness or by sensation. Of consciousness nothing is the object but the internal energies and feelings of our own minds; and with regard to the motion of the sun or of the earth, nothing is perceived by the sense of sight but that, after considerable intervals of time, these two great bodies have repeatedly changed their places in the heavens with respect to each other. This is all that on this subject our *natural sense of things* leads us to believe; and is not this infallibly true? Afterwards indeed, by taking for granted the truth of propositions, for which neither sense nor consciousness affords the shadow of evidence; the vulgar now, and all mankind formerly, reasoned themselves into the opinion, that the earth stands still, and that the sun moves round it. In vulgar philosophy it is taken for granted, that in the universe there is not a *relative* but an *absolute upwards* and an *absolute downwards*; that our heads are absolutely upward, and our feet downward; and that were the earth to revolve round its axis, these positions would be reversed, that our heads would be placed beneath our feet, and that we ourselves would fall from the earth into empty space. Upon these false hypotheses the vulgar reason correctly. They know that bodies cannot change their place without motion; they know that in the time of their remembrance the sun and the earth have been perpetually varying their places with respect to each other; they know that they themselves have never fallen, nor had a tendency to fall, into empty space; and hence they infer that it is the sun and not the earth that moves (K). But will any man say that the absurd suppositions from which this conclusion is logically deduced, have the evidence either of sensation or consciousness, as the permanency of that living agent which each man calls himself has?

To our author's second question we likewise reply with confidence, that the generality of mankind do *not* believe, upon their natural sense of things, that every part of their body remains exactly the same to-day as it was yesterday. It would be strange indeed if they did, after having repeatedly experienced the waste of increased perspiration or sweating; after having witnessed men emaciated by sickness, and again restored to plumpness in health; and after having perhaps lost whole limbs, which certainly their natural sense of things teaches them to consider as parts of their body. In all these cases, the generality of mankind are as sensible of changes having taken place in their bodies as he who has attended ever so closely to physiological inquiries, though not one of them has the least imagination of a change having taken place in the living agent which each man calls himself.

Bishop Butler observes, that if the living agent be perpetually changing, it is a fallacy upon ourselves to charge our present selves with any thing we did, to imagine our present selves interested in any thing which befel us yesterday, or that our present self will be interested in what will befal us to-morrow. To this judicious observation our daring philosopher replies, "that as the man of to-morrow, though not in all points the same with, yet depends for his existence upon, the man of to-day, there is sufficient reason to care about him." Could he have said, that as the man of to-day depends for his existence on the man of to-morrow, there is sufficient reason for the present man to care about the future man; or that as the man of to-morrow depends for his existence on the man of to-day,

(K) This inference too has been so often drawn, that it comes in time to coalesce in the mind with the *sensations*, from which the motion either of the sun or of the earth is deduced with infallible certainty; and hence it is considered as part of that truth which sensation immediately discovers. *See our Chapter of* Association.

day, there is to-day sufficient reason for the future man to care about the present man; we should in either case, if the anachronism had been kept out of sight, have seen the force of his argument. Every man has sufficient reason to care about the ox upon which he is to be fed; but we cannot so clearly perceive what reason the ox has to care about the man.

Not satisfied, it would seem, with this reply, our author proceeds to affirm, "that the man of to-morrow, possessing a reminiscence of the actions of the man of to-day, and knowing that these actions will be referred to him both by himself and others, (which is certainly knowing that both himself and others are most iniquitous wretches), they cannot be indifferent to the man of to-day, who looks forward to the properties of the man of to-morrow;" *i. e.* the reminiscence and knowledge of a future man constitute all the relation that subsists between the present man and his actions; a discovery worthy of an original genius. But as on the subject of personal identity we pretend to no originality, we shall leave this proposition to the meditation of our readers and take the liberty to ask our author a question or two respecting this same reminiscence, which he is graciously pleased to acknowledge for a property.

He defines identity, "the continued existence of any being unaltered in substance or in properties;" and he repeatedly acknowledges that no identical quality or property can be transferred from one subject to another. Let us now suppose, that a man has a reminiscence of an individual action performed a month ago, and that this reminiscence is accompanied with a consciousness that the action was performed by himself. This supposition, whether true or false, may certainly be made; for it implies nothing more than what every man firmly believes of himself in every act of remembrance. Let us again suppose, that, at the distance of ten or twenty years, the man known by the same name has a reminiscence of the same action, with a consciousness that he himself performed it. Is this reminiscence the same with the former? or is it a different reminiscence? If it be the same, either the person remembering at the distance of ten or twenty years is the same with him who remembered at the distance of a month, or there is an identical quality transferred from one substance to another, which is admitted to be impossible. If reminiscence be itself a real and immediate quality of any substance, and not the mere energy of a power, and if the one reminiscence be different from the other, the subjects in which these two different qualities inhere must likewise be different. Yet the man who has the reminiscence at the distance of a month has the evidence of consciousness that the action was performed by him; and the man who has the reminiscence at the distance of ten or twenty years, has likewise the evidence of consciousness that the same action was performed by him and not by another. By the confession of Hume and of all philosophers, consciousness never deceives; but here is the evidence of one consciousness in direct opposition to another; and therefore, as two contradictory propositions cannot both be true, either the one reminiscence is the same with the other, or reminiscence is no real quality. That one act of reminiscence should be numerically the same with another, which followed it at the distance of twenty years, is plainly impossible; whence it should seem, that reminiscence itself is no real and immediate quality of any substance. But if this be so, what is reminiscence? We answer, it is plainly neither more nor less than the *energy* of a power, which though dormant between its energies, remains unchanged from the one to the other, and which being itself the real or immediate quality of a subject, that subject must likewise remain unchanged. That powers may remain dormant, and yet unchanged, every man must be convinced; who having struck any thing with his hand, knows that he has power to repeat the stroke, and yet does not actually repeat it. Two blows with the hand immediately following each other are numerically different, so that the one cannot with truth be said to be the other; but we have the evidence of external sense, that they are both struck by the same member. In like manner, two energies of reminiscence directed to the same object, and succeeding each other at any interval of time, cannot possibly be one and the same energy; but as the latter energy may include in it the former as well as the object remembered by both, we have the evidence of consciousness that both are energies of the same power; and we have seen, that to suppose them any thing else, may be demonstrated to involve the grossest absurdities and contradictions.

Mr Cooper has other arguments to obviate the force of Bishop Butler's demonstration of personal identity; such as, that a "high degree of *similarity* between the two succeeding men is sufficient to make the one care about the other;" and that "a good man, knowing that a future being will be punished or rewarded as the actions of the present man deserve, will have a sufficient motive to do right and to abstain from wrong." But if there be any one of our readers who can suffer himself to be persuaded by such assertions as these, that the living agent which he calls himself is perpetually changing, and at the same time that such change is consistent with the expectation of future rewards and punishments, he would not be reclaimed from his error by any reasoning of ours. We shall therefore trust such trifling with every man's judgment, and proceed to examine our author's *demonstration*, that personal identity has no existence. But here it is no part of our purpose to accompany him through his long chemical rabble, or to controvert his arguments for the non-identity of vegetable and animal bodies. The only thing to which, after Bishop Butler, we have ascribed identity, is that which in man is sentient and conscious; and the non-identity of this thing, whatever it be, Mr Cooper undertakes to demonstrate from the known properties of sensations and ideas.

259. A pretended demonstration that personal identity is impossible.

This demonstration sets out with a very ominous circumstance. The author, after conducting impressions *ab extra*, from the extremities of the nerves to the brain, affirms, that *sensations* and *ideas* are nothing but "motions in the brain perceived;" *i. e.* when a man thinks he is looking at a mountain, not only at rest, but to appearance immoveable, he is grossly deceived; for he perceives nothing all the while but *motion in his brain!* Were not the desire of advancing novelties and paradoxes invincible in some minds, we should be astonished at finding such an assertion as this

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this fall from the pen of any man who had paid the slightest attention to the different energies of his own intellect. Motions in the brain, as we have repeatedly observed, are the immediate causes of our sensations; but is it conceivable, is it possible, that any thing would be the cause of itself? The motion of a sword through the heart of a man is the immediate cause of that man's death; but is the sword or its motion *death* itself, or can they be conceived as being the *sensations* of the *man* in the *agonies* of *dying*? But sensations and ideas, whatever they be, exist in succession; and therefore, argues our demonstrator, no two sensations or ideas can be one and the same sensation or idea. The conclusion is logically inferred; but what purpose can it possibly serve? What purpose, why it seems "sensations and ideas are the only *existences whose existence* we certainly know (a charming phrase, the *existence* of *existences*, and as original as the theory in which it makes its appearance); and, therefore, from the nature of sensations and ideas, there is no such thing as permanent identity." Indeed! what then, we may be permitted to ask, is the import of the word *we* in this sentence? Does it denote a series of sensations and ideas, and does each sensation and each idea certainly know not only itself, but all its ancestors and all its descendants? Unless this be admitted, we are afraid that some other existence besides sensations and ideas must be allowed to be certainly known, and even to have something of a permanent identity. Nay, we think it has been already demonstrated (see chap. of TIME), that were there not something permanent, there could be no time, and of course no notion of a first and last, or indeed of succession, whether of sensations or ideas. And therefore, if we have such a notion, which the author here takes for granted, and upon which indeed his demonstration rests, it follows undeniably that there is something permanent, and that we *know* there is something permanent, which observes the succession of sensations and ideas.

260 Shown to be absurd and ridiculous.

All this, indeed, Mr Cooper in effect grants; for he is not much startled at the appearance of contradictions in his theory. "I find (says he), by perpetually repeated impressions which I perceive, that my hands, body, limbs, &c. are connected, are parts of one whole. I find, by perpetually repeated perceptions also, that the sensations excited by them are constantly similar, and constantly different from the sensations excited by others." He has then repeated perceptions; but how can this be possible, if *he* be not different from the perceptions, and if *he* do not *remain unchanged* while the perceptions succeed each other at greater or less intervals of time? A striking object passing with rapidity before the eyes of a number of men placed beside each other in a line of battle, would undoubtedly excite a succession of sensations; but surely that succession would not take place in the mind of *any individual* in the line, nor could any *single man* in this case say with truth that he had *repeated* perceptions of the object. In like manner, were that which is sentient perpetually changing, no man could possibly say or suppose that he had repeated perceptions of any thing; for upon this supposition, the man of to-day would have no more connection with the man who bore his name yesterday, or twenty years ago, than the last man in the line had with the first.

Upon the whole, we cannot help thinking, that Bishop Butler's demonstration of personal identity remains unshaken by the batteries of Mr Cooper.—It rests, indeed, upon the solid basis of consciousness and memory; and if implicit credit be not given to the evidence of these faculties, we cannot proceed a single step in any enquiry whatever, nor be certain of the truth even of a mathematical demonstration.

261 A difficulty removed.

But as we have ourselves supposed, that to sensation, reminiscence, and every actual energy of the mind of man, the instrumentality of some material system is necessary, it may perhaps be thought incumbent on us to show how the perpetual flux of the particles of matter which compose the brain, as well as all the other parts of the body, can consist with the identity of the person who perceives, remembers, and is conscious. If this cannot be done, our hypotheses, ancient and plausible as it is, must be given up; for of personal identity it is impossible to doubt. In this case, however, we perceive no difficulty; for if there be united to the brain an immaterial being, which is the subject of sensation, consciousness, and will, &c. it is obvious, that all the *intellectual powers* which properly constitute the person, must be inherent in that being. The material system, therefore, can be necessary only as an instrument to excite the energies of those powers; and since the powers themselves remain unchanged, why should we suppose that their energies may not continually be exerted by successive instruments of the same kind, as well as by one permanent instrument? The powers of perception and volition are not in the material system, any more than the sensation of seeing is in the rays of light, or the energy of the blacksmith in the hammer with which he beats the anvil. Let us suppose a man to keep his eye for an hour steadily fixed upon one object. It will not surely be denied, that if this could be done, he would have one uninterrupted and unvaried perception of an hour's duration, as measured by the clock. Yet it is certain, that the rays of light which alone could occasion that perception would be perpetually changing. In like manner, a blacksmith, whilst he continues to beat his anvil, continues to exert the same power whether he uses one hammer all the time, or a different hammer at each stroke. The reason is obvious; the eye, with all its connections of brain and mind in the one case, and the person of the smith in the other, remain unchanged; and in them alone reside the faculty of sensation and the power of beating, though neither the faculty nor the power can be exerted without material instruments. But were it possible that millions of men could in the space of an hour take their turns in rotation with each new ray of light, it is self-evident, that in this case, there would be nothing permanent in sensation; and, therefore, there could not be one uninterupted and unvaried perception, but millions of perceptions, during the hour, totally distinct from and unconnected with each other. Let us now suppose a man to fix his eye upon an object for the space of a minute, and at the distance of a day or a month to fix it upon the same

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object a second time. He would not indeed, in this case, have one uninterrupted and unvaried perception, but he would be conscious of the energy of the very same faculty the second time as at the first. Whereas, were one man to view an object to-day, and another to view the same object to-morrow, it is obvious, that he who should be last in the succession could know nothing of the energy of that faculty by which the object was perceived the first day, because there would be nothing common to the two perceptions.

Thus then we see, that *personal identity* may with truth be predicated of a compound being, though the material part be in a perpetual flux, provided the immaterial part remain unchanged; and that of such a being only is a resurrection from the dead possible.—For since the motions of the brain do nothing more than excite to energy the permanent powers of the mind, it is of no sort of consequence to that energy, whether these motions be continued by the same numerical atoms, or by a perpetual succession of atoms arranged and combined in the very same manner. We shall, therefore, be the same persons at the resurrection as at present, whether the mind be united to a particular system composed of any of the numberless atoms which have in succession made parts of our present bodies, or to a system composed of totally different atoms, provided that new system be organised in exactly the same manner with the brain or material vehicle, which is at present the immediate instrument of perception. This (we say) is self-evident; but were the immaterial part to change with the changing body, a resurrection of the same persons would be plainly impossible.

Chap. IV. *Of the* Immortality *of the* Soul.

262 The immortality of the soul the general belief in all nations.

Wherever men have been in any degree civilized, and in some nations where they have been in the most savage state, it has been the general persuasion, that the mind or soul subsists after the dissolution of the body. The origin of this persuasion, about which disputes have been raised, no Christian hesitates to attribute to revelation. The Egyptians, from whom the Greeks derived many of their theological and philosophical principles, appear to have taught the immortality of the soul, not as a truth discovered by the exertions of human reason, but as a dogma derived to them from the earliest ages by tradition. This indeed may be confidently inferred from the character and conduct of their first Greek disciples. Those early wise men who fetched their philosophy immediately from Egypt, brought it home as they found it, in detached and independent placits. Afterwards, when schools were formed, and when man began to philosophise by hypothesis and system, it was eagerly inquired upon what foundation in *nature* the belief of the soul's immortality could rest; and this inquiry gave rise to the various disquisitions concerning the *substance* of the soul, which have continued to exercise the ingenuity of the learned to the present day. It was clearly perceived, that if consciousness, thought, and volition, be the result of any particular modification of matter and motion, the living and thinking agent must perish with the dissolution of the system; and it was no less evident, that if the being which perceives, thinks, and wills, be not material, the mind of man *may* subsist after the resolution of the body into its component particles. The discovery of the immateriality of the mind was therefore one *step towards* the proof of its immortality; and in the opinion of many philosophers, whose hopes ought to rest on a surer basis, it was alone a complete proof.—"They who hold sensitive perception in brutes (says a pious writer †) to be an argument for the immateriality of their souls, find themselves under the necessity of allowing those souls to be immortal."

† See the Procedure, Extent, and Limits of the Understanding.

263 The philosophers of ancient Greece believed likewise in its pre-existence,

The philosophers of ancient Greece, however, felt not themselves under any such necessity. Whatever were their opinions respecting the souls of brutes, they clearly perceived that nothing which had a beginning of existence could be naturally immortal, whether its substance were material or immaterial.—"There never was any of the ancients before Christianity (says the accurate Cudworth), that held the soul's future permanency after death, who did not likewise assert its pre-existence; they clearly perceiving, that if it were once granted that the soul was generated, it could never be proved but that it might be also corrupted. And, therefore, the assertors of the soul's immortality commonly began here, first to prove its pre-existence, proceeding thence to establish its permanency after death. This is the method of proof used in Plato: Ην που ἡμῶν ἡ ψυχὴ πρὶν ἐν τῷ δε τῷ ἀνθρωπίνῳ εἴδει γενέσθαι, ὥστε καὶ ταύτη ἀθάνατόν τι ἐοικεν ἡ ψυχὴ εἶναι. *Our soul was somewhere before it came to exist in this human form, and thence it appears to be immortal, and as such will subsist after death.*"

264 And absolute eternity.

To give this argument for immortality any strength, it must be taken for granted, not only that the soul existed in a *prior* state, but that it existed from all *eternity*; for it is obvious, that if it had a beginning in any state, it may have an end either in that state or in another. Accordingly, Plato asserts in plain terms its eternity and self-existence, which, as we learn from Cicero, he infers from its being the principle of motion in man. "Quin etiam cæteris, quæ moventur, hic fons, hoc principium est movendi. *Principii autem nulla est origo.* Nam ex principio oriuntur omnia: ipsum autem nulla ex re alia nasci potest: nec enim esset id principium, quod gigneretur aliunde §." This, it must be acknowledged, is very contemptible reasoning; but the opinion which it was intended to prove was held by all the philosophers. They were unanimous in maintaining the *substance* of the soul, though not its *personality*, to be eternal *à parte ante* as well as *ad partem post*; and Cicero, where he tells us that this opinion passed from *Pherecydes*, *Syrus*, to Pythagoras, and from Pythagoras to *Plato*, expresses their notion of the soul's duration by the word *sempiternus* *, which, in its original and proper sense, is applicable only to that which has neither beginning nor end.

§ Tuscul. lib. i. cap. 23.

* Tuscul. lib. i.

Indeed none of the philosophers of ancient Greece appear to have believed a creation (see Creation) possible: for it was a maxim universally received among them, *De nihilo nihil fit, in nihilum nil posse reverti*; that *nothing can come from nonentity, or go to nonentity.* This maxim, as held by the theistical philosophers, the learned Cudworth labours to interpret in a sense agreeable

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able to our notions of the origin of the world; but the quotations urged by himself must convince every competent reader that on this occasion he labours in vain. For instance, when Aristotle writes of Parmenides and Melissus, that ουδεν ουδε γινεθαι φασιν ουδε φθειρεσθαι των οντων, *they say that no real entity is either made or destroyed;* what can be his meaning, but that those philosophers taught that nothing could be either created or annihilated? He testifies the same thing of *Xenophones and Xeno*, when he says that it was a fundamental principle of their philosophy—μη ενδεχεσθαι γινεσθαι μηδεν εκ μηδενος—*that it is impossible that any thing should be made out of nothing.* And of Empedocles, when he relates ατανατα ταυτα κακεινος ὁμολογει ὁτι εκ τε μη οντος αμηχανον εστι γινεσθαι το τε ον εξολλυσθαι ανολεθρον και αρρηκτον—*That he acknowledges the very same thing with other philosophers,* viz. *that it is impossible that any thing should be made out of nothing, or perish into nothing.* But it is needless to multiply quotations respecting the opinions of single philosophers. Of all the physiologers before himself and Plato, Aristotle says, without exception, περι ταυτης ὁμογνωμονουσι της δοξης οἱ περι φυσεως, οτι το γιγνομενον εκ μη οντων γιγνεσθαι αδυνατον‡—*That they agree in this opinion, that it is impossible that any thing should be made out of nothing;* and he calls this the common principle of naturalists; plainly intimating, that they considered it as the greatest absurdity to suppose that any real entity in nature could either be brought from nothing or reduced to nothing.

‡ Physic. lib. 1. cap. 5.

The author of the *Intellectual System*, in order, perhaps, to hide the impiety of this principle, endeavours to persuade his readers, that it was urged only against the hypothesis of forms and qualities of bodies considered as real entities, distinct from matter. But how it could be supposed to militate against that particular opinion, and not against the possibility of all creation, is to us perfectly inconceivable. The father of the school which analysed body into matter and form, together with by far the greater part of his followers, taught the eternity of both these principles (L); and therefore maintained, as strenuously as any atomist, the universal maxim, *De nihilo nihil fit.* Even Plato himself, whose doctrine of *ideas* is supposed to wear a more favourable aspect than Aristotle's *forms* to the truths of revealed religion, taught the *eternity* of *matter;* but whether as a self-existing substance, or only as an emanation from the Deity, is a question which has been disputed. That he admitted no proper creation, may be confidently inferred from Plutarch; who writing upon the generation of animals, according to the doctrine laid down in the *Timæus*, has the following passage: Βελτιον ουν, Πλατωνι πειθομενους τον μεν κοσμον υπο θεου γεγονεναι λεγειν και ειδειν· ὁ μεν γαρ καλλιστος των γεγονοτων ὁ δε αριστος των αιτιων την δε ΟΥΣΙΑΝ και ΥΛΗΝ εξ ης γεγονην ου γεγομενην, αλλα ὑποκειμενην αει τω δημιουργω εις διαθεσιν και ταξιν αυτης, και προς εξομοιωσιν ως δυνατον ην παρασχειν· ου γαρ εκ του μη οντος ἡ γενεσις, αλλ' εκ του μη καλως μηδ' ικανως εχοντος, ὡς οικιας και ἱματιου, και ανδριαντος†. *It is therefore better for us to follow Plato, and to say and sing that the world was made by God. For as the world is the best of all works, so is God the best of all causes. Nevertheless, the* SUBSTANCE *or* MATTER *out of which the world was made, was* NOT *itself made, but was always ready at hand, and subject to the artificer, to be ordered and disposed by him. For the making of the world was not the production of it out of nothing, but out of an antecedent bad and disorderly state, like the making of a house, garment, or statue.*

† Plut. Op. tom. ii. p. 1014.

If, then, this be a fair representation of the sentiments of Plato, and surely the author understood those sentiments better than the most accomplished modern scholar can pretend to do, nothing is more evident, than that the founder of the academy admitted of no proper creation, but only taught that the matter which had existed from eternity in a chaotic state, was in *time* reduced to order by the *Demiurgus*, or supreme Being. And if such were the sentiments of the divine Plato, we cannot hesitate to adopt the opinion of the excellent Mosheim, which the reader will probably be pleased to have in his own words. "Si a Judæis discedas, nescio an ullus antiquorum philosophorum mundum negaverit æternum esse. Omnes mihi æternum professi videntur esse mundum: hoc uno vero disjunguntur, quod nonnulli, ut *Aristoteles*, *formam* et *materiam* simul hujus orbis, alii vero, quorum princeps facile Plato, *materiam* tantum *æternam*, formam vero, a Deo comparatam, dixerunt †."

† Notes on Cudworth's Intellectual System.

Now it is a fact so generally known, as not to stand in need of being proved by quotations, that there was not among them a single man who believed in the existence of mind as a being more excellent than matter, and essentially different from it, who did not hold the superior of at least equal antiquity with the inferior substance. So true is this, that Synesius, though a Christian, yet having been educated in one of the schools of philosophy, could not by the hopes of a bishopric be induced to dissemble this sentiment: αμελει την ψυχην ουκ αξιωσω ποτε σωματος ὑστερογενη νομιζειν*.— *I shall never be persuaded to think my soul younger than my body.* This man probably believed upon the authority of the scriptures, that the matter of the visible world was created in time; but he certainly held with his philosophic masters, that his own soul was as old as any atom of it, and that it had consequently existed in a prior state before it animated his present body. Those

* Epist. 105.

(L) *Aristotelem*, et plerosque Peripateticorum, in vulgus notum est, in hac fuisse sententia—nec *natum* esse, nec *interiturum* unquam hunc mundum. Vid. PETRUS GASSENDUS *Physic.* sect. 1. lib. 1. cap. 6. JAC. THOMASIUS *de Stoica mundi exustione*, Diss. 4. et alii. Plures ita haud dubie senserunt philosophorum veterum. Hinc video MANILIUM in *Astronomico Lib.* 1. inter philosophorum de mundo sententias hanc, ac si præcipua esset, primo commemorare loco:

Quem sive ex nullis repetentem semina rebus,
NATALI QUOQUE EGERE placet, semperque FUISSE,
ET FORE, PRINCIPIO pariter FATOQUE carentem.

Mosheim's edition of Cudworth's Intellectual System, lib. i. cap. 3. sect. 33. note 60. On this subject see also *Ancient Metaphysics*.

Of the immortality of the Soul.

265 They supposed all souls to be emanations from the first mind;

Those who maintained that the world was uncreated, maintained upon the same principle that their souls were uncreated likewise; and as they conceived all bodies to be formed of one first matter, so they conceived all souls to be either emanations from the one first Mind, or discerpted parts of it. Aristotle, who distinguishes between the intellectual and sensitive souls, says expressly of the former, that "it enters from without, and is DIVINE;" adding this reason for his opinion, that "its energy is not blended with that of the body—λειπεται δε τον νουν μονον θυραεν επεισιεναι, και θειον ειναι μονον· ουδε γαρ αυτου την ενεργειαν κοινωσει σωματικη ενεργεια *. As to the Stoics, *Cleanthes* held (as Stobæus informs us †), that "every thing was made out of one, and would be again resolved into one." But let Seneca speak for them all: "Quid est autem, cur non existimes in eo *divini* aliquid existere, qui Dei PARS est? Totum hoc, quo continemur, et unum est, et Deus: et socii ejus sumus, et membra ‖—*Why should you not believe something to be divine in him, who is indeed* PART OF GOD? *That* WHOLE *in which we are contained is* ONE, *and that one is* GOD; *we being his companions and* MEMBERS. Epictetus says, *The souls of men have the nearest relation to God, as being* PARTS *or* FRAGMENTS *of him,* DISCERPTED *and* TORN *from his* SUBSTANCE: συναφεις τω θεω, ἅτε αυτου μορια ουσαι και αποσπασματα. Plato writes to the very same purpose, when, without any softening, he frequently calls the soul *God*, and *part of God*. And Plutarch says, that "Pythagoras and Plato held the soul to be immortal; for that, launching out into the soul of the universe, it returns to its parent and original—Πυθαγορας, Πλατων, αρθαρτον ειναι την ψυχην· εξιουσαν γαρ εις την του παντος ψυχην, αναχωρειν προς τον ομοφυλον †. Plutarch declares his own opinion to be, that "the soul is not so much the work and production of God, as a PART of him; nor is it made BY him, but FROM him, and OUT of him: ἡ δε ψυχη ουκ εργον εστι μονον, αλλα και μερος· ουδ' ΥΠ' αυτου, αλλ' ΑΠ' αυτου, κα' ΕΞ αυτου γεγονεν §. But it is needless to multiply quotations. Cicero delivers the common sentiments of his Greek masters on this head, when he says §, "A natura deorum, ut doctissimis sapientissimisque placuit, HAUSTOS animos et LIBATOS habemus." And again: "Humanus autem animus DECERPTUS EX MENTE DIVINA: cum alio nullo, nisi cum ipso Deo (si hoc fas est dictu), comparari potest."

* De Generatione Animalium lib. ii. cap. 3.
† Eclog. Phys. c. 20.
‖ Epist. 92.
† De Placitis Philosophorum lib. iv. cap. 7.
* Plato Quest.
§ De Divinatione, lib i. cap. 49.

266 But differed in opinion as to the mode of their separation.

Whilst the philosophers were thus unanimous in maintaining the soul to be a part of the self-existent Substance, they differed in opinion, or at least expressed themselves differently, as to the mode of its separation from its divine parent. Cicero and the Stoics talk as if the Supreme Mind were extended, and as if the human soul were a part literally torn from that mind, as a limb can be torn from the body. The Pythagoreans and Platonists seem to have considered all souls as emanations from the divine Substance rather than as parts torn from it, much in the same way as rays of light are emanations from the sun. Plato, in particular, believed in two self-existent principles, God and matter. The former he considered as the supreme Intelligence, incorporeal, without beginning, end, or change; and distinguished it by the appellation of το αγαθον, *the Good*. Matter, as subsisting from eternity, he considered as without any one *form* or *quality* whatever, and as having a natural tendency to disorder. Of this chaotic mass God formed a perfect world, after the eternal pattern of his own mind, and endowed it with a soul or emanation from himself. In the language of Plato, therefore, the universe being animated by a soul which proceeds from God, is called the *son of God*; and several parts of nature, particularly the heavenly bodies, are *gods*. The human soul, according to him, is derived by emanation from God, through the intervention of this soul of the world; and receding farther from the first intelligence, it is inferior in perfection to the soul of the world, though even that soul is debased by some material admixture. To account more fully for the origin and present state of human souls, Plato supposes *, that "when God formed the universe, he separated from the soul of the world inferior souls, equal in number to the stars, and assigned to each its proper celestial abode; but that those souls, (by what means, or for what reason, does not appear), were sent down to the earth into human bodies, as into sepulchres or prisons." He ascribes to this cause the depravity and misery to which human nature is liable; and maintains, that it "is only by disengaging itself from all animal passions, and rising above sensible objects, to the contemplation of the world of intelligence, that the soul of man can be prepared to return to its original state." Not inconsistently with this doctrine, our philosopher frequently speaks of the soul of man as consisting of three parts: or rather he seems to have thought that man has three souls; the first the principle of intelligence, the second of passion, and the third of appetite (M); and to each he assigns its proper place in the human body. But it was only the intellectual soul that he considered as immortal.

* Enfield's Abridgement of Brucker's History of Philosophy.

Aristotle

(M) "Plato triplicem finxit animam; cujus principatum, id est, rationem, in capite, sicut in arce, posuit: et duas partes separare voluit, iram et cupiditatem, quas locis discluſit; iram in pectore, cupiditatem subter precordia locavit." *Ciceronis Tusc. Quest.* lib. i. cap. 10.

This hypothesis has been adopted by the learned author of Ancient Metaphysics: but it cannot be proved by argument, and is in direct opposition to consciousness. Were there three distinct minds in each man—the principles of intelligence, of passion, and of appetite, it is obvious that *each man* would be *three persons*, and that *none* of these persons could know any thing of the powers and properties of the *other two*. The intelligent person could not reason about *passion*, or *appetite*; nor could the persons who know nothing but passion and appetite reason about *intelligence*, or indeed about any thing else. The very question at issue, therefore, furnishes the most complete proof possible, that the same individual which each man calls himself, is the principle of intelligence, of passion, and of appetite; for if the Platonic hypothesis were true, that question could never have been started, as no one individual of the human race could have understood of its terms. It may be just worth while to mention, that the author of Ancient Metaphysics, attributing all motion,

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Aristotle taught, in terms equally express, that the human soul is a part of God, and of course that its substance is of eternal and necessary existence. Some of his followers, indeed, although they acknowledged *two first principles*, the active and the passive, yet held, with the Stoics, but *one substance* in the universe; and to reconcile these two contradictory propositions, they were obliged to suppose matter to be both active and passive. Their doctrine on this subject is thus delivered by Cicero: "De natura ita dicebant, ut eam dividerent in res duas, ut altera esset efficiens, altera autem quasi huic se præbens, ea quæ efficeretur aliquid. In eo, quod efficeret, vim esse censebant; in eo autem quod efficeretur, materiam quandam; in UTROQUE TAMEN UTRUMQUE. Neque enim materiam ipsam coherere potuisse, si nulla vi contineretur, neque VIM SINE ALIQUA MATERIA; nihil est enim, quod non alicubi esse cogatur†." *They divided nature into two things, as the first principles; one whereof is the efficient or artificer, the other that which offers itself to him for things to be made out of it. In the efficient principle, they acknowledged active force; in the passive, a certain matter; but so, that in EACH BOTH OF THESE WERE TOGETHER: forasmuch as neither the matter could cohere together unless it were contained by some active force, nor THE ACTIVE FORCE SUBSIST OF ITSELF WITHOUT MATTER; because that is nothing which may not be compelled to be some where.* Agreeably to this strange doctrine, Arrian, the interpreter of Epictetus, says of himself, ειμι ανθρωπος, μερος των παντων, ως ωρα ημερας, "I am a man (a part of the το παν or *universe*), as an hour is part of the day.

† Academicium, lib. i. cap. 6.

Aristotle himself is generally supposed to have believed in the eternal existence of two substances, *mind* and *matter*; but treating of the generation of animals, he says, εν δε το παντι θερμοτης ψυχικη, ως τροπον τινα παντα ψυχης ειναι πληρη διο συνιστανται ταχεως οποταν εμπεριληφθη*, *In the universe there is a certain animal heat, so as that after a manner all things are full of mind; wherefore they are quickly completed (or made complete animals) when they have received a portion of that heat.* This *heat*, from which, according to Cicero ‡, the Stagyrite derived all souls, has, it must be confessed, a very material appearance; in so much that the learned Mosheim seems to have been doubtful whether he admitted of any immaterial principle in man; but for this doubt there appears to us to be no solid foundation. Aristotle expressly declares, that *this heat is not fire* nor any *such power, but a spirit which is in the seeds or elementary principles of bodies*; τουτο δε ου πυρ, ουδε τοιαυτη δυναμις εστιν, αλλα το εμπεριλαμβανομενον εν τω σπερματι και εν τω αφρωδει πνευμα*. And as the excellent person himself acknowledges (N), that Aristotle taught the existence of two principles, God and matter, not indeed subsisting separately, but eternally linked together by the closest union; we think it follows undeniably, that this heat, from which he derived all souls, must be that mind which he called *God*, and which he considered as the actuating soul of the universe.

* De Generatione Animalium, lib. iii. c. 11.

‡ Tuscul. lib. i. c. 3.

* De Generatione Animalium, lib. ii. c. 3.

Upon these principles neither Aristotle nor the Stoics could believe with Plato, that in the order of nature there was first an emanation from the supreme mind to animate the universe, and then through this universal soul other emanations to animate mankind. The Stagyrite believed, that the Supreme Mind himself is the soul of the world, and that human souls are immediately derived from him. The genuine Stoics, acknowledging but one substance, of necessity considered both the souls and bodies of men as portions of that substance, which they called το εν; though still they affected to make some uninteligible distinction between body and mind. But however the various schools differed as to those points, they were unanimous as to the soul's being a part of the self-existing Substance; and Cicero gives their whole system from Pacuvianus in words which cannot be misunderstood:

Quicquid est hoc, omnia amat, format, alit, auget, creat,
Sepelit, recipitque in sese omnia, omniumque idem est Pater:
Indidemque eadem, quæ oriuntur de integro, atque eodem occidunt.

267 Upon these principles they maintained the necessary existence of the soul;

To these verses he immediately subjoins the following query: "Quid est igitur, cur, cum domus sit omnium una, eaque communis, cumque *animi hominum STEMPER FUERINT, FUTURIQUE SINT* cur ii, quid ex quoque eveniat, et quid quamquerem significet, perspicere non possint‖?" And upon the same principle he elsewhere argues, not merely for the immortality, but for the *eternity* and *necessary existence* of the soul: "Animorum nulla in terris origo invenire potest: His enim in naturis nihil inest, quod vim memoriæ mentis, cogitationis habeat; quod et præterita teneat, et futura provideat, et complecti possit præsentia: quæ sola divina sunt. Nec inveniretur unquam, unde ad hominem venire possint, nisi a Deo. Ita quicquid est illud, quod sentit, quod sapit, quod vult, quod viget, celeste et divinum est OB EAMQUE REM ÆTERNUM SIT NECESSE EST*." This was indeed securing the future permanency of the soul in the most effectual manner; for it is obvious, that what had not a beginning can never have an end, but must be of eternal and necessary existence.

‖ De Divinatione, lib. i. cap. 57.

* Frag de Consolatione.

268 But not in its distinct and personal capacity.

But when the ancients attribute a proper eternity to the soul, we must not suppose that they understood it to be eternal in its *distinct* and *personal existence*. They believed that it proceeded or was *discerpted* in *time* from the

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tion, and even the coherence of the minute particles of body, to the immediate agency of mind, of course furnishes every human body with at least *four minds*. This fourth mind differs not from the *plastic nature* of Cudworth, and is likewise a Platonic notion apparently better founded. That there are in our bodies motions perpetually carried on by the agency of something which is not the principle of either our intelligence, our passions, or our appetites, is a fact which cannot be denied; but if those motions proceed immediately from mind, it must be either from the *supreme* mind, or from some *subordinate* mind, acting under the supreme, but wholly *distinct from and independent* of that which each man calls himself.

(N) "Non cum illis componi prorsus potest ARISTOTELES, qui bina rerum separataque statuunt principia, Deum et materiam. Arctissime enim utrumque hoc initium conjunxit Stagyrita, atque ipsa naturæ necessitate Deum cohærere cum mole hac corporea putavit." *Cudworth's Intellectual System*, Book I. Chap iv. Sect. 6. Note 3.

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the substance of God, and would *in time* be again *resolved* into that substance. This they explained by a closed vessel filled with sea-water; which swimming a while upon the ocean, does, on the vessel's breaking flow in again, and mingle with the common mass. They only differed about the time of this reunion; the greater part holding it to be at death; but the Pythagoreans not till after many transmigrations. The Platonists went between these two opinions; and rejoined pure and unpolluted souls immediately to the Universal Spirit; but those which had contracted much defilement, were sent into a succession of other bodies, to be purged and purified, before they returned to their parent substance. ‡"

‡ Warburton's Divine Legation.

299 A similar doctrine held by the Bramins.

A doctrine similar to this of Plato has been held from time immemorial by the Bramins in India, whose sacred books teach, "That intellect is a PORTION of the GREAT SOUL of the universe, breathed into all creatures, to animate them for a certain time; that after death it animates other bodies, or returns like a *drop* into that *unbounded ocean* from which it first arose; that the souls of men are distinguished from those of other animals, by being endowed with reason and with a consciousness of right and wrong; and that the soul of him who adheres to right as far as his powers extend, is at death ABSORBED INTO THAT DIVINE ESSENCE, never more to reanimate flesh. On the other hand, the souls of those who do evil, are not at death disengaged from all the elements; but are immediately cloathed with a body of fire, air, and *akash* (a kind of celestial element, through which the planets move, and which makes no resistance) in which they are for a time punished in hell. After the season of their grief is over, they reanimate other bodies; and when they arrive through these transmigrations at a state of purity, they are absorbed into God, where all PASSIONS are UTTERLY UNKNOWN, and where CONSCIOUSNESS IS LOST IN BLISS ‡."

‡ See preliminary Dissertion to Dow's History of Indostan.

270 This doctrine incompatible with a future state of rewards and punishments, and

Whether the Greeks derived their notions of the divinity and transmigration of souls from the east, or whether both they and the Bramins brought the same doctrines at different periods from Egypt, it is foreign from the purpose of this article to inquire. Certain it is, that the philosophers of Greece and India argued in the very same manner, and upon the very same principles, for the *natural* immortality of the soul; and that the immortality which they taught was wholly incompatible with God's moral government of the world, and with a future state of rewards and punishments. That this is true of the doctrine of the Bramins, is evident from the last quoted sentence; for if the soul, when absorbed into the Divine essence, loses all consciousness of what it did and suffered in the body, it cannot possibly be rewarded for its virtues practised upon earth. That the philosophers of Greece taught the same cessation of consciousness, might be inferred with the utmost certainty, even though we had not Aristotle's express declaration to that purpose: For as they all believed their souls to have existed before they were infused into their bodies, and as each must have been conscious that he remembered nothing of his former state (o), it was impossible to avoid concluding, that in the future state of his soul as little would be remembered of the present. Accordingly, Aristotle teaches, that "the agent intellect only is immortal and eternal, but the passive corruptible",—τουτο μονον αθανατον και αιδιον ὁ δε παθητικὸς νους φθαρτος *. Cudworth thinks this a very doubtful and obscure passage; but Warburton, whose natural acuteness often discovered the sense of ancient authors when it had escaped the sagacity of abler scholars, has completely proved, that by the *agent intellect* is meant the *substance* of the soul, and by the *passive* its *particular perceptions*. It appears therefore that the Stagyrite, from the common principle of the soul's being a part of the Divine substance, draws a conclusion against a future state of rewards and punishments; which though all the philosophers (except Socrates) embraced, yet all were not so forward to avow.

* De Anima, lib. iii. cap. 6.

271 Grosly absurd in itself;

That the hypothesis of the soul's being a part of the Divine substance is a gross absurdity, we surely need not spend time in proving. The argument long ago urged against it by St Austin must ere now have occurred to every reader. In the days of that learned father of the church, it was not wholly given up by the philosophers; and in his excellent work of the *City of God*, he thus exposes its *extravagance* and impiety: "Quid infelicius credi potest, quam dei partem vapulare, cum puer vapulat? Jam vero *partes Dei* fieri *lascivas*, *iniquas*, *impias*, atque omnino *damnabiles*, quis ferre potest nisi qui prorsus insanit?"

272 Yet the only principle from which the soul can be inferred to be essentially immortal.

But though this hypothesis be in the highest degree absurd and wholly untenible, we apprehend it to be the only principle from which the *natural* or *essential* immortality of the soul can possibly be inferred. If the soul had a *beginning*, it *may* have an *end*; for nothing can be more evident than that the being which had not existence of itself cannot of itself have perpetuity of existence. Human works, indeed, continue in being after the power of the workman is withdrawn from them; but between human works and the Divine there is this immense difference, that the former receive from the artist nothing but their form; whereas the latter receive from the Creator both their form and their substance. Forms are nothing but modifications of substance; and as substances depend upon God and not upon man, human works are continued in being by that fiat of the Creator, which made the substances of which they are composed susceptible of different forms, and of such a nature as to retain for a time whatever form may be impressed upon them. Human works therefore are continued in being by a power different from that by which they are finished; but the works of God depend wholly upon that power by which they were originally brought into existence; and were the Creator to withdraw his supporting energy, the whole creation would sink into nothing.

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(o) This is expressly acknowledged by Cicero, though he held with his Greek masters the eternity of the soul. In answer to some very foolish assertions concerning the evil of death, he says, "Ita, quia nondum dati sunt, miseri jam sunt, quia non sunt: et nos ipsi, si post mortem miseri futuri sumus, miseri fuimus antequam nati. Ego autem *non commemini, antequam sum natus, me miserum.* *Tuscul.* lib. 1. cap. 6.

Immortality of the Soul.

Self-evident as this truth certainly is, some eminent philosophers *seem* to have questioned it. "No substance or being (says Mr Baxter*) can have a natural tendency to annihilation, or to become nothing. That a being which once exists should cease to exist is a real effect, and must be produced by a real cause: But this cause could not be planted in the nature of any substance or *being* to become a tendency of its nature; *for it could not be a free cause*, otherwise it must be a *being* itself, the subject of the *attribute freedom*, and therefore not the property of another *being*; *nor a necessary cause*, for such a cause is only the effect of something imposing that necessity, and so no cause at all."

273 Baxter's argument for the natural or essential immortality of the soul.

* Inquiry into the Nature of the human Soul, vol. i. sect. 3.

That the author's meaning in this argument is good, cannot, we think, be controverted; but he has not expressed himself with his usual accuracy. He seems to confound *causes* with the *absence* of causes, and the *effects* of the *former* with the *consequences* of the *latter*. The visible world was brought into existence by the actual energy of the power of God; and as the visible world had nothing of itself, it can *remain* in existence only by a *continuance* of the *same energy*. This energy therefore is at the present moment as *real a cause* as it was six thousand years ago, or at any past period when it may have been first exerted; and the visible world is its *real and permanent effect*. But would the ceasing of this energy be likewise a *cause?* It would certainly be followed with the annihilation of the visible world, just as the withdrawing of the sun-beams would be followed with darkness on the earth. Yet as no one has ever supposed that darkness, a non-entity, is a *positive effect* of the sun or of his beams, but only a mere negative consequence of their absence; so, we think, no one who believes in creation can consider that destruction which would inevitably follow the withdrawing of the energy by which all things are supplied, as the *positive effect* of a contrary energy, or as any thing more than a *negative consequence* of the ceasing of that volition or energy of power by which God at first brought things into existence. For "where the *foundation* of existence lies *wholly* in the power of an infinite Being *producing*, the *ground* of the *continuance* of that existence must be wholly in the same power *conserving*; which has, therefore, with as much truth as frequency, been styled a continued creation (P)."

274 Inconclusive,

The force of this reasoning Mr Baxter certainly saw when he said, that "a tendency to persevere in the same state of nature, and a tendency to change it are contradictories, and impossible to be planted in the same subject at once; or, not to urge the contradiction, if the last prevailed, the remaining in the same state for any given time would be impossible. We forget the true cause of all these tendencies, *the will of God*, which it is absurd to suppose contrary to itself. The tendency in matter to persevere in the same state of rest or motion, is nothing but *the will of the Creator*, who preserves all things in their existence and manner of existence: nor can we have recourse to any other cause for the preservation of immaterial substance in its existence. Therefore these tendencies are to be ascribed to the will of God, and it is absurd to suppose them contrary."

275 and in effect given up by himself.

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All this is unquestionably true. The existence or non-existence of matter and created spirits depends wholly upon the will of God; and we cannot suppose him to be willing to-day the reverse of what he willed yesterday, because we know that all his volitions are directed by unerring wisdom. We have likewise the evidence of experience, that nothing is ever suffered to perish but particular systems, which perish only *as systems* by a decomposition of their parts. A being which like the soul has no parts, can suffer no decomposition; and therefore, if it perish, it must perish by annihilation. But of annihilation there has not hitherto been a single instance; nor can we look for a single instance without supposing the volitions of God to partake of that unsteadiness which is characteristic of man. Corporeal systems, when they have served their purpose, are indeed resolvable into their component parts; but the matter of which they are composed, so far from being *lost*, becomes the matter of *other systems* in endless succession. Analogy, therefore, leads us to conclude, that when the human body is dissolved, the immaterial principle by which it was animated continues to think and act, either in a state of separation from all body, or in some material vehicle to which it is intimately united, and which goes of with it at death; or else that it is preserved by the Father of spirits, for the purpose of animating a body in some future state. When we consider the different states through which that living and thinking *individual* which each man calls himself, goes, from the moment that it first animates an embryo in the womb, to the dissolution of the man of fourscore; and when we reflect likewise on the wisdom and *immutability* of God, together with the various dissolutions of corporeal systems, in which we know that a single atom of matter has never been lost; the presumption is certainly strong, that the soul shall subsist after the dissolution of the body. But when we take into the consideration the *moral* attributes of God—his justice and goodness, together with the unequal distribution of happiness and misery in the present world; this presumption from analogy amounts to *complete moral proof* that there shall be a future state of rewards and punishments (Q) (See MORAL *Philosophy* and RELIGION); and if we estimate the duration of the rewards by the benevolence of Him by whom they are to be conferred, we cannot imagine them shorter than eternity.

276 Analogical evidence of the immortality of the soul, and a moral proof of a future state of rewards and punishments.

(P) See Stillingfleet's *Origines Sacræ*, where this question is treated in a very masterly manner by one of the ablest metaphysicians of the last century. See also our article PROVIDENCE.

(Q) It was by such arguments that Socrates reasoned himself into the belief of a future state of rewards and punishments. He was singular, as we have already observed, in this belief; and he was as singular in confining himself to the study of morality. "What could be the cause of this belief, but this restraint, of which his belief was a natural consequence? For having confined himself to morals, he had nothing to mislead him; whereas the rest of the philosophers, applying themselves with a kind of fanaticism to *physics* and *metaphysics*, had drawn a number of absurd though subtile conclusions, which directly opposed the consequences of those moral arguments." *Warburton's Div. Leg.*

Of Necessity and Liberty.

Chap. V. *Of* Necessity *and* Liberty.

277 Freedom of agency implied in accountableness.

In the preceding chapter we have adverted to that great *moral proof* for a future state, and the immortality of the soul, arising from the relation in which man, as a being accountable for his conduct, stands to a God of almighty power, infinite wisdom, and perfect justice. But the circumstance of accountableness implies freedom of agency; for it is contrary to all our notions of right and wrong (see Moral *Philosophy*), that a man should be either rewarded or punished for actions which he was necessitated or compelled to perform.

278 Every man has power to do what he wills:

Human actions are of three kinds: one, where we act by instinct without any view to consequences; one, where we act by will, in order to obtain some end; and one, where we act against will. It is the second kind of actions only which confers upon the agent merit or demerit. With respect to the first, he acts blindly (see Instinct), without deliberation or choice; and the external act follows from the instinctive impulse, no less necessarily than a stone by its gravity falls to the ground. With respect to the last, he is rather an instrument than an agent; and it is universally allowed, that were a strong man to put a sword into the hand of one who is weaker, and then to force it through the body of a third person, he who held the sword would be as guiltless of the murder as the sword itself. To be intitled to rewards, or liable to punishment, a man must act voluntarily; or in other words, his actions must proceed from that energy of mind which is termed *volition:* and, we believe, it has never been denied, that all men have power to do whatsoever they *will*, both with respect to the operations of their minds and the motion of their bodies, uncontrolled by any foreign principle or cause. "Every man (says Priestley) is at liberty to turn his thoughts to whatever subject he pleases, to consider the reasons for or against any scheme or proposition, and to reflect upon them as long as he shall think proper; as well as to walk wherever he pleases, and to do whatever his hands or other limbs are capable of doing." Without such liberty as this, morality is inconceivable.

279 But different opinions entertained of the freedom of volition.

But though philosophers have in general agreed with respect to the power which a man has to perform such actions as he wills, they have differed widely in opinion respecting the nature of his volitions. That these are the result of motives, has seldom if ever been questioned; but whether that result be necessary, so as that the agent has no self-determining power to decide between different motives, has been warmly disputed by men equally candid, impartial, and intelligent. The principal writers on the side of necessity are, Hobbes, Collins, Hume, Leibnitz, Lord Kames, Hartley, Edwards, Priestley, and perhaps Locke. On the other side are, Clarke, King, Law, Reid, Butler, Price, Bryant, Wollaston, Horsley, Beattie, and Gregory, &c. To give a short view of this celebrated question, is all that our limits will permit; and as we do not think ourselves competent to settle the dispute, it were perhaps a thing desirable to give the opposite reasonings in the words of those eminent authors themselves. It must, however, be obvious to the reader, that the style and manner of so many different writers are extremely various, and that to introduce them all into our abstract, would make the whole a mass of confusion. We shall, therefore, select one writer to plead the cause of necessity, supplying his defects from those who, though inferior to him on the whole, may yet have argued more ably on some particular points which the question involves: and to this combined reasoning we shall subjoin such answers as to us appear most conclusive. Hartley, Hume, and Priestley, are perhaps the most profound reasoners on the side of necessity; but there is so much more perspicuity in the arguments of Lord Kames, that we cannot help preferring them, as being on the whole better calculated to give the ordinary reader a fair view of the subject.

280 Scheme of necessity, according to Lord Kames.

"Into actions done with a view to an end (says his Lordship §), desire and will enter: desire to accomplish the end goes first; the will to act, in order to accomplish the end, is next; and the external act follows of course. It is the will then, that governs every external act done as a mean to accomplish an end; and it is desire to accomplish the end that puts the will in motion; desire, in this view, being commonly termed the *motive* to act. But what is it that raises desire? The answer is ready: It is the prospect of attaining some agreeable end, or evading one that is disagreeable. And if it be enquired, what makes an object agreeable or disagreeable? the answer is equally ready: It is our nature that makes it so. Certain visible objects are agreeable, certain sounds, and certain smells: other objects of these senses are disagreeable. But there we must stop, for we are far from being so intimately acquainted with our own nature as to assign the causes.

§ Sketches of the History of Man, Book iii. Sketch 2. part 1. sect. 8.

"With respect to instinctive actions, no person, I presume, thinks that there is any freedom. With respect to voluntary actions, done in order to produce some effect, the necessity is the same, though less apparent at first view. The external action is determined by the will; the will is determined by desire; and desire by what is agreeable or disagreeable. Here is a chain of causes and effects, not one link of which is arbitrary, or under command of the agent: he cannot will but according to his desire; he cannot desire but according to what is agreeable or disagreeable in the objects perceived: nor do these qualities depend on his inclination or fancy; he has no power to make a beautiful woman ugly, nor to make a rotten carcase smell sweetly.

"Many good men, apprehending danger to morality from holding our actions to be necessary, endeavour to break the chain of causes and effects abovementioned; maintaining, that whatever influence desire or motives may have, it is the agent himself who is the cause of every action; that desire may advise, but cannot command; and, therefore, that a man is still free to act in conradiction to desire and to the strongest motives.

"That a being may exist which in every case acts blindly and arbitrarily, without having any end in view, I can make a shift to conceive: but it is difficult for me even to imagine a thinking and rational being, that has affections and passions, that has a desirable end in view, that can easily accomplish this end; and yet after all can fly off or remain at rest, without any cause, reason, or motive, to sway it. If such a whim-

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whimsical being can possibly exist, I am certain that man is not that being. There is not perhaps a person above the condition of a changeling, but can say *why* he did so and so, what moved him, what he intended. Nor is a single fact stated to make us believe that ever a man acted against his own will or desire who was not compelled by external force.—On the contrary, constant and universal experience proves, that human actions are governed by certain inflexible laws; and that a man cannot exert his self-motive power but in pursuance of some desire or motive.

"Had a motive always the same influence, actions proceeding from it would appear no less necessary than the actions of matter. The various degrees of influence that motives have on different men at the same time, and on the same man at different times, occasion a doubt, by suggesting a notion of chance. Some motives, however, have such influence as to leave no doubt: a timid female has a physical power to throw herself into the mouth of a lion roaring for food; but she is with-held by terror no less effectually than by cords: if she should rush upon a lion, would not every one conclude that she was a frantic? A man, though in a deep sleep, retains a physical power to act, but he cannot exert it. A man, though desperately in love, retains a physical power to refuse the hand of his mistress; but he cannot exert that power in contradiction to his own ardent desire, more than if he were fast asleep. Now, if a strong motive have a necessary influence, there is no reason for doubting, but that a weak motive must also have its influence, the same in kind, though not in degree. Some actions indeed are strangely irregular; but let the wildest actions be scrutinised, there will always be discovered some motive or desire, which, however whimsical or capricious, was what influenced the person to act. Of two contending motives, is it not natural to expect that the stronger will prevail, however little its excess may be? If there be any doubt, it must arise from a supposition, that a weak motive may be resisted arbitrarily. Where then are we to fix the boundary betwixt a weak and a strong motive? If a weak motive can be resisted, why not one a little stronger, and why not the strongest? Between two motives opposing each other, however nearly balanced, a man has not an arbitrary choice, but must yield to the stronger. The mind, indeed, fluctuates for some time, and finds itself in a measure loose: at last, however, it is determined by the more powerful motive, as a balance is by the greater weight after many vibrations.

"Such, then, are the laws that govern our voluntary actions. A man is absolutely free to act according to his own will; greater freedom than which is not conceivable. At the same time, as man is made accountable for his conduct to his Maker, to his fellow-creatures, and to himself, he is not left to act arbitrarily; for at that rate he would be altogether unaccountable: his will is regulated by desire; and desire by what pleases or displeases him.—Thus, with regard to human conduct, there is a chain of laws established by nature; no one link of which is left arbitrary. By that wise system, man is made accountable; by it he is made a fit subject for divine and human government; by it persons of sagacity foresee the conduct of others; and by it the prescience of the Deity with respect to human actions is clearly established."

Of the doctrine of necessity, a more perspicuous or plausible view than this is not to be found in any work with which we are acquainted. It is indeed defective perhaps, as his Lordship only *hints* at the *nature* of that relation which subsists between motive and action; but from his comparing the fluctuations of the mind between two contending motives, to the vibrations of a balance with different weights in the opposite scales, there is no room to doubt but that he agreed exactly in opinion with Mr Hume and Dr Priestley. Now both these writers hold, that the relation of motives to volition and action, is the very same with that which subsists between cause and effect in physics, as far as they are both known to us. 281 Mr Hume, and

"It is universally allowed (says Mr Hume †), that matter, in all its operations is actuated by a necessary force; and that every natural effect is so precisely determined by the energy of its cause, that no other effect, in such particular circumstances, could possibly have resulted from it. The degree and direction of every motion is, by the laws of nature, prescribed with such exactness, that a living creature may as soon arise from the shock of two bodies, as motion in any other degree or direction than what is actually produced by it. Would we, therefore, form a just and precise idea of *necessity*, we must consider whence that idea arises, when we apply it to the operation of bodies. But our idea of this kind of necessity and causation arises entirely from the uniformity observable in the operations of nature, where similar objects are constantly conjoined together, and the mind is determined by custom to infer the one from the appearance of the other. These two circumstances form the whole of that necessity which we ascribe to matter. Beyond the *constant conjunction* of similar objects, and the consequent *inference* from one to the other, we have no notion of any necessity or connection." He then gives a pretty long detail to prove a great uniformity among the actions of men in all nations and ages; and concludes that part of his argument with affirming, "not only that the conjunction between motives and voluntary actions is as regular and uniform as that between the cause and effect in any part of nature; but also, that this regular conjunction has been universally acknowledged among mankind, and has never been the subject of dispute either in philosophy or common life." He afterwards observes, "that men begin at the wrong end of this question concerning liberty and necessity, when they enter upon it by examining the faculties of the soul, the influence of the understanding, and the operations of the will. Let them first discuss a more simple question, namely, the operations of body, and of brute unintelligent matter; and try whether they can there form any idea of causation and necessity, except that of a constant conjunction of objects and subsequent inference of the mind from one to another. If these circumstances form in reality the whole of that necessity which we conceive in matter, and if these circumstances be also universally acknowledged to take place in the operations of the mind, the dispute is at an end; at least must

† Inquiry concerning Human Understanding, sect. 8.

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must be owned to be thenceforth merely verbal. When we consider how aptly *natural* and *moral* evidence link together, and form only one chain of argument, we shall make no scruple to allow that they are of the same nature, and derived from the same principles.—Between a connected chain of natural causes and voluntary actions, the mind feels no difference in passing from one link to another; nor is less certain of a future event which depends upon motives and volitions, than if it were connected with the objects present to the memory and senses by a train of causes, cemented together by what we are pleased to call a *physical* necessity. The same experienced union has the same effect on the mind, whether the united objects be motives, volition and action, or figure and motion. We may change the names of things, but their nature and their operation on the understanding never change."

282 Dr Priestley.

Dr Priestley, in words a little different, teaches the very same doctrine which was taught by Mr Hume.—"In every determination of the mind (says he *), or in cases where volition and choice are concerned, all the previous circumstances to be considered are the *state of mind* (including *every thing belonging to the will itself*), and the *views of things* presented to it; the latter of which is generally called the *motive*, though under this term some writers comprehend them both. To distinguish the *manner* in which events depending upon *will* and *choice* are produced, from those in which no volition is concerned, the former are said to be produced *voluntarily*, and the latter *mechanically*. But the same general maxims apply to them both. We may not be able to determine *à priori* how a man will act in any particular case; but it is because we are not particularly acqainted with his *disposition of mind*, *precise situation*, and *views of things*. But neither can we tell in which way the wind will blow to-morrow, though the *air* is certainly subject to no other than necessary laws of motion.

* The Doctrine of philosophical Necessity illustrated.

"It is universally acknowledged, that there can be no effect without an adequate cause. This is even the foundation on which the only proper argument for the being of a God rests. And the necessarian asserts, that if, in any given state of mind, with respect both to *disposition* and *motives*, two different determinations or volitions be possible, it can be so on no other principle, than that one of them shall come under the description of an *effect without a cause*; just as if the beam of a balance might incline either way, though loaded with equal weights. It is acknowledged, that the mechanism of the balance is of one kind, and that of the mind of another: and, therefore, it may be convenient to denominate them by different words; as, for instance, that of the balance may be termed a *physical*, and that of the mind a *moral* mechanism. But still, if there be a *real mechanism* in both cases, so that there can be only one result from the same previous circumstances, there will be a *real necessity*, enforcing an absolute certainty in the event. For it must be understood, that all that is ever meant by *necessity in a cause*, is that which produces *certainty in the effect*."

Such is the nature of human volitions, according to every necessarian of eminence who has written on the subject since the days of Hobbes: and if this theory be just, if there be a constant and inseparable conjunction of motives and actions similar to that of cause and effect in physics, it is obvious, that in volition the mind is as inert as body is in motion.

283 View of human liberty.

This consequence is indeed avowed and insisted upon by Hume, Priestley, and their adherents; whilst the advocates for human liberty, on the other hand, contend for an absolute exemption of the will from all internal *necessity*, arising from its own frame and constitution, the impulse of superior beings, or the operations of objects, reasons, or motives, &c. By this they do not mean, that between motives and volitions there is no relation whatever, or that a man can ever choose evil as evil, or refuse good as good. Such an assertion would be contrary to consciousness and universal experience. But what they endeavour to prove is, that the conjunction of motive and volition is not inseparable, like that of cause and effect in physics; that a man may in most cases choose according to any one of two or more motives presented to his view; that by choosing any thing, he may make it in some measure agreeable by his own act, or, to speak more properly, may bend his desire to it; that in volition, the mind is not inert; and that, therefore, we are under no *necessity* to act in a particular manner in any given case whatever.

That the conjunction of motive and action is not constant like that of cause and effect in physics, and that by consequence the mind in forming volitions is not inert, has been evinced by Dr Gregory with the force and precision of mathematical demonstration.—Former writers on the side of liberty had often observed, that upon the supposition of the *inertia* of mind, a man, with equal and opposite motives presented at once to his view, would, during their continuance, remain perfectly at rest, like a balance equally loaded in both scales. The observation is admitted to be just by all the advocates for necessity; but they contrive to evade its consequences, by denying that in any given case a man can be at once assailed by two equal and opposite motives. Thus, when it is said that a porter, standing with his face due north, must remain in that position at perfect rest, as long as equal motives shall at once be offered to him for travelling eastward and westward, the necessarians admit the force of the argument; but when it is added that a guinea, offered for every mile that he should travel in each of these opposite directions, ought therefore to fix him at rest till one of the offers be withdrawn, they deny that the desire of gaining the guineas is the *whole* of the motives which operate upon his mind. He may have, say they, some secret reason which we cannot discern for preferring the one direction to the other; and that reason, added to the guinea, will make him go eastward or westward, just as an ounce thrown into either scale of a balance poised by equal weights will make that scale preponderate. Though we think that this solution of the difficulty can satisfy no man who is not already biassed to the necessarian system; and though, even were it to be admitted, it seems to militate against the constant conjunction of motives and actions, unless it can be proved that the porter must travel the road which he has been necessitated to choose with reluctance and a heavy heart; yet as it may admit of endless quibbling upon ambiguous words,

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words, the philosophical world is much indebted to Dr Gregory ‡ for an argument which, in our opinion can neither be overturned nor evaded, and which demonstrates that the conjunction of motive and action cannot be constant and inseparable, like that of cause and effect in physics.

‡ Essay on the Relation between Motive and Action.

284 Demonstration that the conjunction of motive and action is constant.

His reasoning is to this purpose: Suppose a porter to be offered a guinea for every mile that he shall travel directly eastward. If there be no physical cause or moral motive to keep him at rest, or to induce him to move in another direction, there cannot be a doubt, upon either hypothesis, but he will gladly embrace the proposal, and travel in the direction pointed out to him, till he shall have gained as much money as to satisfy his most avaricious desires. The same thing would have happened if a guinea had been offered for every mile that he should travel due south. In these two cases taken separately, the relation between the man's motives and his actions would be strikingly analogous to that between a single impulse and motion in physics. Let us now suppose the two offers to be made at the same instant, and the man to be assured that if he travel eastward he can have no part of the reward promised for his travelling to the south, and that if he travel southward he can have no part of the reward promised for his travelling to the east. What is he to do in this case? If his mind be inert in volition, and if the two motives operate upon him with the same necessity that causes operate in physics, it is obvious that the man could travel neither towards the east nor towards the south, but in a diagonal direction from north-west to south-east; and this he must do *willingly*, although perfectly satisfied that he could gain nothing by his journey. As this inference is contrary to fact and universal experience, the Doctor very justly concludes that the premises, from which it is deduced by mathematical reasoning, must be false and absurd; or, in other words, that the relation between motive and action cannot be that of constant conjunction, like the relation between cause and effect in physics.

He uses many arguments of the same kind, and equally convincing, to prove the absurdity of supposing the inertness of mind, and only an occasional conjunction of motives and actions; but we forbear to quote them, both because we wish his book to be read, and because we think the single argument which we have borrowed from him sufficient to demolish the theory of Priestley and Hume, which rests wholly upon the hypothesis of the *constant* conjunction of motive and action.

But is it then not really true, that the external action is determined by the will, the will by desire, and desire by what is agreeable or disagreeable? That the external action is universally determined by the will, is certainly true; but that the will is necessitated and universally determined by the desire is as certainly false. If Potiphar's wife was handsome, and made her proposal to Joseph with any degree of female address; and if his constitution was like that of other young men; there cannot be a doubt but that he felt a *desire* to do what she requested of him: yet we know that he *willed* to do otherwise, and in direct opposition to his *desire* fled from the room. Perhaps it may be said, that his volition to flee was the effect of a contrary and stronger *desire* not to sin against God; but this is confounding the reader, by calling two energies of mind, between which there is little or no similarity, by the same name. He perceived, or knew, that to comply with his mistress's request would be to sin against God; he knew that he ought not to sin against God, and therefore he chose or determined himself not to do it. We can easily conceive how the presence, attitudes, and address, of the lady might be agreeable to him, and excite desire. There may very possibly be more than one of our readers, who during the course of their lives, have experienced something of the same kind: but could abstract truth be in the same way agreeable, so as to excite in his mind a *desire* of virtue sufficient to annihilate or banish the *desire* of the woman? As well may it be said that one sensation can annihilate another, that the beautiful colours of the rainbow can remove the sensation of stench from the mind of him who is plunged into the midst of a dunghill, or that the smell of a rose can make a man insensible to the pain of a stroke inflicted by a bludgeon. Sensitive desire, and the perception of duty, are things so totally different, that to consider them as operating against each other like different weights in the opposite scale of a balance, is as absurd as to suppose that sound can operate against colour, or colour against smell. A man may prefer sound to colour, or colour to smell, and act accordingly; but the determination must be wholly his own, unless these two sensations be themselves either agents or physical causes of the *same kind*, like the weights in the opposite scales of the balance.

285 Men do not always determine themselves by the strongest motive.

The advocates for liberty do not pretend, that in matters of importance a man ever acts without some motive or reason for his conduct. All that they insist upon is, that between two or more motives of different kinds he has a liberty of choice, and that he does not always determine himself by that which he knows to be the greatest. Without such freedom, they think men might be often brought into situations where they could not act at all, and where inaction would at the same time be in the highest degree absurd. Thus, were two bags of gold, containing each a thousand or ten thousand guineas, to be placed on the same table, before a man whose family is perishing for want, and were the man to be told that he might take either of them, but not both, is it conceivable that he would be held in perpetual suspence between the two? No; he would instantly and with alacrity take up one of them without feeling the least regret for the want of the other. This action would, indeed, be the consequence of a very powerful motive, the desire to obtain honestly that wealth of which he and his family stood so much in need. That motive, however, being general, would draw him equally to both bags; and it remains with the necessarians to say by what else than a self determining power he could take either the one or the other. When it is affirmed, that such self-determination would be an effect without a cause, the advocates for liberty cannot help thinking that their antagonists are guilty of advancing as an argument a *petitio principii*; for the affirmation is true, only if the mind in volition be inert, and the *inertia* of the mind is the sole question at issue. If the mind be not inert, it is plain, that in consequence of a man's self-determination, no effect would be produced without a suf-

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a sufficient cause. At any rate, motives cannot be causes. In the proper sense of the word, a cause is that which produces an effect; but the production of an effect requires active power; and power being a quality must be the quality of some being by whom it may be exerted. Power may be dormant, and therefore power without will produces no effect. Are motives, then, real beings, endowed with power and will? No; they are only views of things or mental conceptions, which in the strictest sense of the word are passive; and between two motives the mind determines itself, without receiving an impulse from either.

Nor is it only between motives of equal force that men have the power of determining themselves. Whoever believes in a future state of rewards and punishments, and yet acts in a manner which he knows to be offensive to Him who is to be the future and final judge, unquestionably prefers to the strongest of all motives, another which even to himself appears to have comparatively but very little strength. Whether there be men who occasionally act in this manner, is a question which can be decided only by an appeal to every one's conciousness. That there are, we can have no doubt, for we never met with a single individual, not biassed by system, who was not ready to acknowledge, that during the course of his life he had done many things, which at the time of action he clearly perceived to be contrary to his true interest. Without a self determining power in the mind, this could never be the case. Did motives operate with the necessity of physical causes, it is obvious that in every possible situation the strongest must constantly prevail; and that he who in certain circumstances had in time past done any particular thing, would on a return of the same circumstances do the very same thing in every time future. Dr Priestley, indeed, wishes to persuade his readers that this is actually the case. "In every determination of the mind (says he), or in cases where volition and choice are concerned, all the previous circumstances to be considered are the *state of mind* (including *every thing belonging to the will itself*), and the various views of things presented to it;" and he affirms, that "whenever the same precise circumstances occur twice, the very same determination or choice will certainly be made the second time that was made the first." This is an assertion of which no man can controvert the truth; for it is an identical proposition. If in the circumstances previous to the determination of the mind, *every thing* belonging to the *will itself* must be included, it is self-evident that he who in any given circumstances has acted a particular part, will on a return of these circumstances act the same part a second time; for this is only saying, that he who on two different occasions shall exert volitions of the same tendency, will not on these occasions exert volitions of which the tendencies are different. But the question to be decided is, Whether a man, in the same general state of mind, possessed of the same degree of health, and conscious of the same appetites, must, in external circumstances perfectly alike, necessarily exert at all times the same volitions. That the human mind is under no such necessity, we think every man's consciousness and experience may abundantly satisfy him; for there are, perhaps, but very few who have not at one time resisted temptations, to which at another they have chosen to yield.

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286 If they did, folly as well as merit and demerit would be banished from the world.

That there is a relation between motives and actions, must be confessed; but that relation is neither *necessity*, nor constant conjunction. If it were, all actions would be perfectly rational; and folly, as well as merit and demerit, would be banished from the conduct of men. What is the particular nature of that relation which subsists between the voluntary actions of men, and the motive from which they proceed, can be known to every individual only by an attentive and unbiassed reflection on the operations of his own mind. Without this reflection, no man can be made to understand it by the reasonings of philosophers, and with it no man can need the aid of those reasonings. That a self-determining power, such as that for which we plead, contributes to the sum of human happiness, has been shown by Archbishop King and his ingenious translator; who have proved, with the force of demonstration, that the mind can take pleasure in the object of its choice, though that object be in itself neither agreeable nor disagreeable to our natural appetites; and that if it could not, it would be vain in such a world as ours to hope for any portion of felicity. Into that detail our limits will not permit us to enter: but to the reader who wishes for further information, we beg leave to recommend the last edition of King's Origin of Evil, by Dr Law late bishop of Carlisle; without, however, vouching for the truth of all the opinions advanced by either of those learned writers.

Before we conclude this chapter, it may be proper to observe, that it is only in volition that we are conscious of any original active power in ourselves, and that without such consciousness we could never have acquired the *notion* of active power. In our desires and appetites, we neither are active nor suppose ourselves active. Lord Kames, and most necessarians, confound desire with volition: but that they are perfectly distinct is plain from this circumstance, that we daily *desire* many things which we know to be wholly *out* of our own power*, whereas no man ever *willed* what he did not believe to be *in* his own power. We all *desire* or wish that our children may be virtuous, wise, and happy; and though we are conscious that it is not in our power to make them so, we cannot banish the desire from our breasts. But madmen only have ever *willed* virtue, wisdom, and happiness, to any person; and if there was ever a man so extravagantly mad as to exert such a volition as this, he has at the time fancied himself a divinity, and therefore believed that the object of his volition depended upon himself. When the astronomer, whose character is so admirably drawn by our great master of moral wisdom †, fancied himself the regulator of the weather and the distributor of the seasons he might *will* either *rain* or *sunshine* as he thought proper, because he considered the object of his volition as depending upon a power imparted to him from heaven; but though he might *desire*, he could not *will*, the rising or the falling of *winds*; for these he confessed were not subjected to his authority. In a word, without freedom in volition, power is inconceivable; and therefore it is as certain that we are free agents as that we have any notion of active powers.

* Reid's Essays on the active powers, &c.

† Rasselas Prince of Abyssinia.

CHAP.

Of the Being and Attributes of God.

Chap. VI. *Of the* Being *and* Attributes *of* God.

It has been already observed, that as of bodies there are various kinds, endowed with various properties; so the probability is, that of minds endowed with different powers, or different degrees of power, the variety may be as great, or perhaps greater. The existence and powers of our own minds are made known to us by consciousness and reflection; and from our dependent state, and the mutability of the objects around us, we are necessarily led to infer the existence of another mind, which is independent, unchangeable, eternal, and the cause of all things which have a beginning of existence. Between that mind and our own, we can hardly avoid believing that there are many orders of "thrones, dominations, princedoms, virtues, powers;" but as we have no intuitive knowledge of such intermediate beings, and cannot from any thing which we perceive discern the *necessity* of their existence, they are not properly the object of science. The existence, however and many of the attributes of One First Cause, are capable of the strictest demonstration; "for the invisible things of Him from the creation of the world are clearly seen, being understood by the things which are made."

287 The existence of God capable of demonstration.

Of this great truth, the most important by far which can occupy the mind of man, many demonstrations have been given both by divines and by philosophers. We shall lay before our readers such a one as to us appears perfectly conclusive, being founded on the intuitive knowledge which we have of our own existence, and therefore independent of all theories about the nature and reality of the material world.

Every man, whether he adopt the common theory or that of Berkeley respecting matter, is conscious that he *himself* exists, and must therefore grant that *something now* exists. But if any thing exist *now* *, then must something have *always* existed; otherwise that thing which *now* exists, must either have been created by *nothing*, i. e. have been *caused by no cause*, or else it must have *created itself*, acting before it existed. Both these suppositions are so palpably absurd, that no atheist has avowed them, either among the ancients or the moderns. We must therefore admit, either that there is some one *independent* being, which now exists, and always has existed; or that the things which we know to exist at present (every man's *self* for instance), were produced by *something* which had its *existence* from *something else*, which also depended upon *some other cause*, and so on in an *infinite series of caused* or *successive beings*. But this last supposition, though it has been often made, is as grossly absurd as either of the two former. For of this infinite series, either *some one* part has *not* been successive to any other, or else *all* the several parts of it have been successive. If some one part of it was *not successive*, then it had a *first part*; which destroys the supposition of its infinity (R). If *all* the several parts of it have been successive, then have they all once been *future*; but if they have *all* been future, a time may be conceived when none of them had existence: and if so, then it follows, either that all the *parts*, and consequently the *whole* of this infinite series, must have arisen from *nothing*, which is absurd; or else that there must be something in the *whole* besides what is contained in *all the parts*, which is also absurd.

*See Notes to King's Origin of Evil.

288 Some one independent Being has existed from eternity.

As the possibility or impossibility of an infinite series of dependent beings is the main question at issue between the atheists and us, we shall state the preceding reasoning in a manner somewhat different. For this purpose, let us suppose some one to affirm, that the course of generation has had no beginning, and consequently that the number of successive births has been infinite. We would ask such a person, Whether before the birth of Abraham, for example §, there had past an infinite series of generations or not? If not, the course of generation must have had a beginning, which is the conclusion for which we contend. But if the series past was infinite, then at the birth of Joseph the great-grandson of Abraham, it is evident, that more generations were past, and that the number then was greater than that which was supposed to be infinite; so that upon this supposition we have a number that is both infinite and not infinite, which is a manifest contradiction. Should it be said that the number of generations was infinite, as well at the birth of Abraham as at the birth of Joseph; it will then follow, that one infinite may be greater than another of the very same kind; and consequently that an infinite may be bounded, *i. e.* be finite. But should it be alledged, that the number of births at Abraham's was finite, and became infinite when it reached to Joseph's, it will then follow, that one finite number added to another may make an infinite number, which is directly contrary to every possible notion of infinity. We might argue in the same manner against an infinite series of every kind, the very supposition of which involves the most palpable contradictions. See Chap. *Of* Infinity *and* Eternity.

§ See an Essay towards an Eviction of the Being and Attributes of God by Seth Ward—Printed at Oxford, 1654.

289 Whose duration is not commensurate with succession, and

From the impossibility of an infinite series it necessarily follows, that there exists, and must have existed from eternity, some one independent being, whose duration cannot be commensurate with succession, and to whom the relation of time is not applicable. Here will some atheists presently imagine, that by the same mode of reasoning they may disprove the existence of God: for do not they who thus destroy the eternity of the world, destroy at the same time the eternity of the Creator? If time itself be not eternal, how can the Deity or any thing else be so?

In urging these questions, it must be taken for granted that time is essential to all existence, and that God cannot be eternal otherwise than by a successive flux of infinite time. But it has been already shown (n° 225), that successive duration is not essential to existence; that we can even *conceive* existence without succession; and it may here be added, that if we suppose a perfect being alone in nature, we shall find it impossible to imagine any *succession of ideas*, any *flux of moments*, or any *alteration* or *increase* whatever in his knowledge and essence.

(R) Των απειρων ουκ εστιν ουδεν πρωτον. *Arist. Phys.* lib. viii. cap. 5. sect. 4.

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essence. Such duration as we are acquainted with can have no relation to an immutable Being, while supposed to exist alone; but as soon as he determined to exercise his several attributes in the production of something distinct from himself, then, and not till then, have we reason to think that *time*, *succession*, and *increase*, began. These atheistical questions, therefore, instead of containing an objection to the existence of a Deity, afford a plain demonstration of it: for since it is not more evident that something now exists than that something must have existed from eternity; and since it has been shewn that neither the world in its present state, nor time, nor any thing capable of change nor succession, can possibly be eternal; it follows, that there must necessarily be some Being who, in the order of nature, is before time, and who, in the stability and immutable perfection of his own intelligence, comprehends at once his *yesterday*, *to-day* and *forever*. "The atheists (says the excellent Cudworth *) can here only smile, or make wry faces, and show their little wit in quibbling upon *nunc-stans*, or a *standing now of eternity*; as if that *standing eternity* of the *Deity* (which with so much reason has been contended for by the ancient *genuine theists*(were nothing but a *pitiful small moment of time standing still*, and as if the duration of all beings whatsoever must needs be like our own: whereas the duration of every thing must of necessity be agreeable to its nature; and therefore, as that whose *imperfect nature* is ever *flowing* like a river, and consists in *continual motion* and *changes* one after another, must needs have accordingly a *successive* and *flowing duration*, sliding perpetually from *present* into *past*, and always hasting on towards the *future*, expecting something of itself which is not yet in being; so must that whose perfect nature is *essentially immutable* have *permanent and unchanging duration*, never losing any thing of itself once present, nor yet running forward to meet something of itself which is yet not in being."

* Intellectual System, Book i. chap. 5.

290 who is self-existent, and

From the eternity of the supreme Being we necessarily infer his dependence on self-existence; for that which never had a *beginning* of existence cannot possibly have any cause of that existence, or in any manner depend upon any other being, but must exist of itself, or be *self-existent*.

291 cannot cease to be.

Eternity *ad partem post*, or *necessary existence*, or the impossibility of ever ceasing to be, follows from independence: For to the nature of that which exists without any cause, existence must be essential. But a being whose existence is of itself and essential to its nature, cannot be *indifferent* to existence or non-existence, but must exist *necessarily*. And here it may be proper to observe, that the word *necessity*, when applied to existence, may be taken in two acceptations very different from each other †; either as it arises from the relation which the existence of that thing, of which it is affirmed, has to the existence of *other things*; or from the relation which the *actual* existence of that thing has to the *manner* of its *own* existence.

† Notes to King on Evil, and Law's Inquiry into the Ideas of Space, &c.

292 What is meant by necessary existence.

In the former sense, when necessity of existence has relation to the existence of other things, it denotes that the supposition of the *non*-existence of that thing of which necessity is affirmed, implies the non-existence of things which we *know to exist*. Thus, some independent being does *necessarily exist*; because, to suppose *no independent* being, implies that there are *no dependent beings*; the contrary of which we know to be true.

In the second sense, when the necessity of his existence arises from the relation which the actual existence of any thing has to the *manner* of its own existence, necessity means, that the thing, of which it is affirmed, exists after such a manner as that it never could in *time past* have *been non-existent*, or can in *time future cease to be*. Thus, *every independent being*, as it exists without a cause, is *necessarily* existing; because existence is *essential* to such a being; so that it never could *begin* to exist, and never can *cease to be*: For to suppose a being to begin to exist, or to lose its existence, is to suppose a *change* from non-entity to entity, or *vice versa*; and to suppose such a change is to suppose a cause upon which that being depends. Every being, therefore, which is independent, *i. e.* which had no cause of existence, must exist *necessarily*, and cannot possibly have begun to exist in time past, or cease to be in time future.

293 Only one necessarily-existent being in the former sense; and

These two kinds of necessity as applied to existence, though they have been often confounded, are in themselves perfectly distinct: For though a being cannot be necessarily existent in the *former* sense without being so in the latter also; yet it may be necessarily existent in the latter sense without being so in the former. For any thing that we know to the contrary, there may be two or more beings existing *necessarily* in the latter sense of the word *ne essity*, i. e. with regard to *independence* and the *manner* of their own existence: but in the former sense of the word, *i. e.* in relation to *this system*, there can be but *one necessarily* existent being; for it is obvious that no more are necessary to account for the production of the *dependent* beings which we know to exist. To suppose the non-existence of *all independent* beings, implies the non-existence of all dependent beings, ourselves and every thing else; but to suppose the non-existence of all independent being except *one*, involves in the supposition no such absurdity.

294 though there might be more than one in the latter, they would be no gods to us.

Thus the phenomena of nature leads us, by the strictest reasoning, to one first cause, which is sufficient for the production; and therefore none but *one* first cause can in this sense of the word be *necessary*: And though several mere *independent* beings might possibly exist, yet they would be no gods to us; they would have no relation to us demonstrable by reason, nor we any thing to do with them. For if the supposition of their existence were not requisite to the production of this system, which it obviously would not be, we could *perceive* no necessity for it at all; we could never discover it by our own faculties, and therefore it could be nothing to us. And tho' two or three such beings should exist, and act in the formation and government of their *respective* systems, or *agree in one*; yet till their existence and operations were made known to us, and a natural relation discovered, nothing would be due from us to them. They would have no *religious* or *moral* relations to us; and we should have no reason to call more than one of them *our* creator, preserver, and governor, which is the proper sense of the word *God*.

To shew in this manner that there is only *one* eternal self-existent Being which bears the relation of *God to us*, seems to be going as far as is necessary, or as natural

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tural light will lead us. Those who endeavour to *demonstrate* that there *cannot possibly* be *more than one* self-existent Being, either reason in a circle, or proceed upon principles which their antagonists cannot be compelled to grant. When they deduce the Divine unity from independence or omnipotence, they evidently presuppose it in their definition of these attributes: and when they infer it from the nature of space and duration, which they consider as modes of the self-existent Being, they take it for granted, that space and duration have a real existence, independent of us and our thoughts; and that the one is infinite and the other eternal, contrary to what has been already proved, we think, with the force of demonstration. The celebrated Dr Clarke made much use of space and duration in his attempt to demonstrate that there can be but one self-existent Being; but he argues for the same thing from the nature of necessity as applied to existence.

295 Impossible to demonstrate that there can be but one self-existent Being.

296 Dr Clarke's first demonstration of the unity

"Necessity (says he*), absolute in itself, is *simple* and *uniform* and *universal*, without any possible *difference*, *difformity*, or *variety*, whatsoever: and all *variety* or *difference* of *existence* must needs arise from some *external* cause, and be *dependent upon it*, and *proportionable* to the efficiency of that *cause*, whatsoever it be. *Absolute necessity*, in which there can be *no variation* in *any kind* or *degree*, cannot be the *ground* of existence of a *number* of Beings, however *similar* and *agreeing*: because, without any *other difference*, even *number* is itself a manifest *difformity* or *inequality* (if I may so speak) of *efficiency* or *casuality*."

* Demonstration of the Being and Attributes of God, Prop. 7.

297 examined, and shown to be inconclusive.

Such is this great man's first argument from necessity, to prove that there cannot be more than one self-existent Being. But what is this *necessity* which proves so much? It is the ground of existence (he says) of that which exists of itself; and if so, it must, in the order of nature, and in our conceptions, be antecedent to that being of whose existence it is the ground. Concerning such *a* principle, there are but three suppositions which can possibly be made; and all of them may be shown to be absurd and contradictory. We may suppose either the *substance* itself, some *property* of that substance, or something *extrinsic* to both, to be this *antecedent ground* of existence prior in the order of nature to *the first cause*.

One would think, from the turn of the argument which here represents this antecedent necessity as *efficient* and *causal*, that it were considered as something *extrinsic* to the first cause *. Indeed if the words have any meaning in them at all, or any *force* of argument, they must be so understood, just as we understand them of any external cause producing its effect. But as an *extrinsic* principle is absurd itself, and is besides rejected by Dr Clarke, who says expressly, that "of the thing which derives not its being from any other thing, this *necessity* or ground of existence must be *in* the thing itself," we need not say a word more of the last of these suppositions.

* Dissertation on the Argument à priori, added to Law's Inquiry into the Ideas of Space, Time, Immensity, &c.

Let us then consider the first; let us take the *substance* itself, and try whether *it* can be conceived as *prior* or *antecedent* to itself in our conceptions or in the order of nature. Surely we need not observe that nothing can be more absurd or contradictory than such a supposition. Dr Clarke himself repeatedly affirms, and it would be strange indeed if he did not affirm, that no *being*, no *thing* whatever, can be conceived as in any respect prior to the first cause.

The only remaining supposition is, that some *attribute* or *property* of the self-existent Being may be conceived as in the order of nature *antecedent* to that being. But this, if possible, is more absurd than either of the two preceding suppositions. An *attribute* is *attributed* to its *subject* as its ground or support, and *not* the *subject* to its *attribute*. A *property*, in the very notion of it, is *proper* to the substance to which it belongs, and *subsequent* to it both in our conceptions and in the order of nature. An *antecedent* attribute, or *antecedent* property, is a solecism as great, and a contradiction as flat, as an *antecedent subsequent* or *subsequent antecedent*, understood in the same sense and in the same syllogism. Every property or attribute, as such, presupposes its subject; and cannot otherwise be understood. This is a truth so obvious and so forcible, that it sometimes extorts the assent even of those who upon other occasions labour to obscure it. It is confessed by Dr Clarke ‡, that "the scholastic way of proving the *existence* of the self-existent Being from the absolute perfection of his nature, is ὑστερον πρωτερον. For all or any perfections (says he) presuppose existence; which is a *petitio principii*." If therefore properties, modes, or attributes in God, be considered as perfections (and it is impossible to consider them as any thing else), then, by this confession of the great author himself, they must all or any of them *presuppose* existence. It is indeed immediately added in the same place, "that bare necessity of existence does not presuppose, but infer existence;" which is true only if such necessity be supposed to be a principle *extrinsic*, the absurdity of which has been already shown, and is indeed universally confessed. If it be a *mode* or *property*, it must *presuppose* the existence of its subject, as certainly and as evidently as it is a *mode* or a *property*. It might perhaps *à posteriori* infer the existence of its subject, as effects may infer a cause; but that it should infer in the other way *à priori* is altogether as impossible as that a *triangle* should be a *square*, or a *globe* a *parallelogram*.

‡ Answer to the Sixth Letter.

298 A second demonstration of the same author

Doubtful, as it would seem, of the force of his first argument, which even those who pretend to be convinced by it acknowledge to be obscure, the Doctor gives a second, which we must confess appears to us to be still more obscure, and if possible less conclusive. "To suppose two or more *distinct beings* existing *of themselves* necessarily and *independent* of each other, implies (he says) this *contradiction*, that *each* of them being independent from the other, they may either of them be supposed to exist *alone*; so that it will be no contradiction to suppose the other not to exist; and consequently *neither of them* will be necessarily existing. Whatsoever therefore exists necessarily is the one simple essence of the self-existent Being; and whatsoever differs from that is not necessarily existing, because in absolute necessity there can be no *difference* or *diversity* of existence.

"Necessity is used here in two different senses ‡, both as *absolute* and *relative*. In the former, neither of the two beings can exist without the other, *i. e.* without our supposing the other to exist also, since that is equally necessary. In the latter, either of them may exist alone, *i. e.* without the help of the other, or without the supposition of the other as requisite to its own existence.

‡ Law's Inquiry into the ideas of Space, &c. chap. 6.

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existence. The consequence therefore that either of them may exist alone, and so neither of them is necessary, is a mere *equivocation* on *necessity*, using it both in an absolute and relative sense at the same time." But as this is a question of the highest importance, and as the author was a man of great worth, we shall consider his argument upon the supposition that the word *necessity* has from the beginning to the end of it the same invariable meaning.

299 examined and shown to be equally inconclusive.

It has been already observed, that there are only two senses in which that word can be applied to the existence of any being; and whether it be here used in the one or the other of these senses, the reasoning, if resolved into a syllogism, will appear to be inconclusive. If the word be taken in that sense of necessity which arises from the relation that dependent beings which we know to exist bear to some one independent Being, the argument will stand thus:

From a known effect no more causes can be *necessarily* inferred than what are sufficient to account for that effect: but

One self-existent and independent Being is sufficient to account for all the phenomena of nature; therefore, from the phenomena, &c.

No more than *one* such Being can be *necessarily* inferred to exist.

But though no more than *one* independent being can in this sense of the word *necessarily* exist, it by no means follows from this syllogism, that two or more such beings may not *possibly* exist. It is, indeed, a plain contradiction to say, that two or more self-existent beings are in this sense *necessary*; but surely there is no contradiction in saying, that two or twenty such beings are *possible*. We could not, therefore, by this argument, convict a person of absurdity, who should affirm that two or more independent beings *actually* exist. We might, indeed, deny the existence of them all but *one*, because one is sufficient to account for those phenomena, from which alone we know that *any* independent being exists; but because one of them might be supposed to exist *alone*, so that it would be no contradiction to suppose the other not to exist; we know not how the Doctor came to affirm, in direct opposition to his own demonstration, that *not one* of them would be necessarily existing.

Necessity, as applied to existence, in the other sense of the word, arises, as we have seen, from the relation which the *actual* existence of the being, of which it may be affirmed, has to the *manner* of that being's existence. It is the same necessity, we are told *, with that which is the *cause* of the unalterable proportion between two and four; and it is considered as the *formal* cause or *ground* of the existence of an independent being. Were it not for the strange expressions *formal cause* and *ground* of *existence*, we should have no objection to this account of that *necessity* by which a being independent undoubtedly exists: but this kind of necessity is a principle which will not support the superstructure which the learned author labours to raise upon it. The same *necessity* which is the cause of the unalterable proportion between *two* and *four*, is likewise the cause of the unalterable proportion between *three* and *six*, between *four* and *eight* and between *five* and *ten*, &c. But if it can be the cause of so many different proportions of the same kind, why may it not be the *formal cause* or *ground* of existence to as *many independent beings* of the same kind as well as to *one*? The following syllogism, we apprehend, to be legitimate both in mode and figure, and its conclusion is directly contrary to the proposition which the Doctor deduces from the same notion of necessity.

* Answer to the Sixth Letter, from a Gentleman in Gloucestershire.

If necessity, considered as a *formal cause* or *ground* of *existence*, be in *one instance* of its causality the formal cause or ground of existence to *many things* of the same kind, it *may* likewise in *every other instance* of its causality, be the formal cause or ground of existence to many things of the same kind.

But such necessity, in that instance of its causality where it is the formal cause or ground of existence to the unalterable proportion between two and four, *is* the formal cause or ground of existence to *many proportions* of the same kind.

Therefore, the same necessity in that other instance of its causality, where it is said to be the formal cause or ground of existence to *one* independent being, undoubtedly *may be* the formal cause or ground of existence to *many independent beings* of the same kind.

300 Necessity, a dangerous principle.

Thus it appears, that *necessity*, in any sense in which it can be properly affirmed of existence, cannot be the foundation of any argument to prove the impossibility of more than one self-existent being. It is indeed a principle from which we apprehend that no positive conclusion whatever can be deduced by reasoning *à priori*. That necessity of existence may be predicated of a being which is independent and uncreated, is self-evident; because to the *nature* of such a being existence is essential. But whilst *that nature* itself remains wholly *incomprehensible* by us, it is impossible that we should discover, by our own unassisted reason, whether it can be the nature of *only one*, or of *more than one* independent being. To argue from necessity, as if it were the cause or ground of existence to such a being, is certainly absurd, if it be not impious; for if that to which existence is essential, does not exist without any cause efficient or formal, we shall be obliged to inquire after a cause or ground of this cause, and thus be involved in all the absurdities and contradictions of an infinite series. We have insisted the longer on this point, because *necessity*, as the foundation of the argument *à priori*, has sometimes been employed to very bad purposes. Attempts have been made from the notion of *necessary* existence, to prove that the Supreme Being cannot be a free agent, and to set the first principles of the religion of nature at variance with those which are revealed in the scriptures.

301 The unity of God highly probable.

But though we are firmly persuaded that the divine unity cannot be *demonstrated à priori*, we are far from thinking it incapable of any *proof*. On the contrary, the common arguments *à posteriori* drawn from the *order* and *harmony* of the world, have always satisfied us, and in our opinion must satisfy every person capable of proportioning his assent to evidence, that the Creator and Preserver of such a system has but *one will* and *one intelligence*, and therefore is himself but *one being*. But *proof* is one thing; and *demonstration* is, in the proper sense of the word, another.

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ther (G). And if we cannot arrive at *absolute* certainty concerning this important truth by the light of nature, we ought to be the more thankful for that revelation, which has put the unity of God past disputes to all who believe the holy scriptures.

302 God omnipotent.

The being which is self-existent and independent must be also *omnipotent*. That such a being has *active power in some degree*, is shown at the same time and by the same medium that we prove his existence; and since he depends upon no cause for his existence or his power, he cannot depend upon any for the exertion of that power, and consequently no *limits* can be applied to it. Limitation is an *effect* of some *superior cause*, which in the present instance there cannot be: consequently to suppose *limits* where there can be no *limiter*, is to suppose an *effect* without a *cause*. For a being to be *limited* or *deficient* in any respect †, is to be *dependent* in that respect on some *other* being which gave it just so much and no more; consequently that being which in *no respect* depends upon any other is in *no respect* limited or deficient. In all beings capable of increase or diminution, and consequently incapable of *perfection* or *absolute infinity*, *limitation* or *defect* is indeed a necessary consequence of existence, and is only a *negation* of that perfection which is wholly incompatible with their nature; and therefore in these beings it requires no further cause. But in a being *naturally capable* of *perfection* or absolute *infinity*, all *imperfection* or *finiteness*, as it cannot flow from the *nature* of that being, seems to require some *ground* or *reason*; which reason, as it is foreign from the being itself, must be the effect of some other external cause, and consequently cannot have place in the *first cause*. That the self-existent being is *capable* of perfection or absolute infinity must be granted, because he is manifestly the subject of one infinite or perfect attribute, viz. *eternity*, or absolute invariable existence. In this respect his existence has been shown to be perfect, and therefore it *may* be perfect in every other respect also. Now that which is the subject of one infinite attribute or perfection, must have all its attributes infinitely or in perfection; since to have any perfections in a finite limited manner, when the subject and these perfections are both *capable* of strict *infinity*, would be the forementioned absurdity of positive limitation without a cause. To suppose this eternal and independent being limited *in* or *by* its own *nature*, is to suppose some *antecedent nature* or *limiting quality* superior to that being, to the existence of which no *thing* no *quality*, is in any respect *antecedent* or *superior*. And to suppose that there is no such thing as *active power* in a being which is evidently the fountain of all power, is the grossest of all absurdities. The same method of reasoning will prove knowledge and every other perfection to be *infinite* in the Deity, when once we have proved that perfection to belong to him at all; at least it will show, that to suppose it limited is unreasonable, since we can find no manner of *ground* for limitation in any respect; and this is as far as we need go, or perhaps as natural light will lead us.

† Notes to King on Evil.

303 Omnipotence can do every thing which does not imply a contradiction.

Of the omnipotence of the supreme Being some philosophers, as well theists as atheists, have talked very absurdly. *Hobbes* ‖, with a view to make this attribute appear impossible and ridiculous, affirms "that God by his omnipotence or infinite power could turn a tree into a sylogism." And *Des Cartes* *, though certainly no atheist, childishly asserts, that all things whatever, even abstract truth and falsehood, do so depend upon the arbitrary will and power of God, as that if he had pleased "twice two should not have been four, nor the three angles of a plain triangle equal to two right ones." But the true notion of Omnipotence, so far from implying a power to turn a tree into a syllogism, or to make twice two not equal to four, implies only that the being possessed of it can actually perform whatever can be conceived by the most perfect understanding; conception in this case being the measure of possibility. Now every thing may be conceived by a mind sufficiently enlarged which does not involve in it a direct contradiction; but what we clearly discern to imply a contradiction, such as that a thing may be and not be at the same instant, cannot be conceived by any intellect, or made to exist by any power. And thus has this attribute of the Divinity been always stated, not only by the wiser Christians, but also by most of the ancient philosophers themselves, who expressly admit that "nothing is exempted from the divine power, but only to make that which hath been done to be undone." (H)

‖ Leviath. chap. 3.

* Responf. ad Objectiones Sextas, § 6.

And here it may be asked, Whether creation, in the

(G) John Gerhard and John Vossius both cite *Gabriel Biel* as acknowledging the unity of God to be incapable of rigid demonstration; and with the sentiments of that schoolman, those two learned divines profess their own to agree.

Sed Biel (1. Sant. Dist. 2. Q. 10. Art. 3.), statuit "quod tantum *unum* esse Deum, sit *creditum* et *non-demonstratum* ratione naturali nobis in via possibili." Id nos ita interpretamur; etiamsi ex *naturæ libro* rationes *non contemnendæ* pro *unitate* divinæ essentiæ afferenda erui possint, eas tamen ad fidei πληροφοριαν cordibus nostris ingenerandam, non satis efficaces esse. Ergo mens prius confirmanda est ex *verbo Dei*, et illustribus testimoniis in quibus se Deus generi humano patefecit: Postea utiliter potest addi consideratio philosophicarum demonstrationum. *Gerhard. Loc. Comm. Tom. I.* p. 106.

Dissentit *Gabriel Biel*, qui ante annos hosce 140 *Tubingensi* Gymnasio præfuit. Is censet *probabiles* magis rationes esse quam *evidentes* et *certas*.—Verum esto sane, ut solæ non sint αποδεικτικαι: At magnum iis pondus addit *traditio* vetus; tum autem quod argumenta isthæc, si non prorsus αποδεικτικα, saltem usque adeo *probabilia* sint, ut της πολυθειας patroni nihil ullius momenti adferre valeant; cur plusquam unum statuere deum potius conveniat. *Voss. de Idolatria, Lib.* 1. *c.* 2.

(H) το δε γεγονος ουκ ενδεχεται μη γενεσθαι· διο αγαθως Αγαθων.
Μονου γαρ αυτου και θεος στερισκεται,
Αγενητα ποιειν, ὁσα αν ἡ πεπραγμενα. *Arist. ad Nichomach.* lib. 6. cap. 2.

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304 Creation possible to Omnipotence.

the proper sense of the word (see CREATION), be within the compass of infinite power. All the ancient philosophers, who were uninlightened by the rays of divine revelation, held that it is not †; grounding their opinion upon this maxim, *Ex nihilo nihil fit.* But the maxim will support no such conclusion.—The ancients, or at least the Peripatetic school, with the metaphysics of which we are best acquainted, considered four kinds of causes, the *efficient*, the *material*, the *formal*, and the *final*; and though they extended the maxim to the first *two*, if not to all these causes, it is a self-evident truth only when applied to the *efficient cause*. Without the actual exertion of *power*, it is indeed most certain that nothing could be brought into existence; but it is so far from being clear that pre-existent matter, or, as Aristotle chose to express himself, a *material cause*, must be supposed for infinite power to operate upon, that, we think, every man may find complete evidence of the contrary in himself. That sensation, intelligence, consciousness, and volition, are not the result of any modifications of figure and motion, is a truth as evident as that consciousness is not swift, nor volition square. If then these be the powers or properties of a being distinct from matter, which we think capable of the completest proof, every man who does not believe that his mind has existed and been conscious from eternity, must be convinced that the power of creation has been exerted in himself. If it be denied that there is any immaterial *substance* in man, still it must be confessed, that, as matter is not essentially conscious, and cannot be made so by any particular organization, there is some real *thing* or *entity*, call it what you please, which has either existed and been conscious from eternity, or been in time brought from non-entity into existence by an exertion of infinite power.

† See Mosheim's Dissertation on this Subject, in his Edition on Cudworth's Intellectual System.

To this perhaps some one may object, that upon our own supposition of the inability of the human mind to exert its faculties but in union with some material and organised system, the mind of every man may have existed from eternity without being conscious of its own existence; and that, therefore, we have in ourselves no evidence of *creation*, but only of the union of two self-existent substances, which in their prior state had been distinct and separate from each other. But such an objection as this, we beg leave to reply, can arise from nothing but misapprehensions of our hypothesis, and of the reasons by which we think it supported. We suppose, that to the exertion of the human faculties, a body of some kind or other may be necessary as an instrument, not merely for what we observe of the dependence of perception and memory on the state of the brain, but because we cannot conceive a Creator of infinite wisdom and goodness to immerse in systems of matter, minds to which he knows that such systems must be always useless and often hurtful. We believe therefore, that our souls and bodies were created and formed for each other; but as our present adversaries admit not of a Creator, we must ask them, How their self-existent souls have been disposed of from eternity, and by what power they have all in due succession been united each to its proper body? as before the union they were not conscious, they could not unite themselves; and to suppose them united by some superior intelligence, is to suppose them in some respects dependent on that intelligence, which seems not to accord with the self-existence. Whatever is self-existent and eternal must be independent; and if possessed of any power, cannot be conceived to have that power limited.—We repeat, therefore, that every man has in himself sufficient evidence that creation is possible; for if infinite power can create an immaterial and percipient being, it may surely be supposed capable of creating dead and unintelligent matter.

But the creation of the material system may be shown to be in the highest degree probable by other arguments. The same reasoning which proves the impossibility of an infinite series and of eternal time, proves that the universe cannot have existed from eternity in its present state. But if it has not existed from eternity in its present state, it belongs to the opponents of creation to say what was its former. We talk indeed of *chaos*; but such language, when a Creator is not admitted, is most unphilosophical trifling. It appears from the most accurate inquiries that have been made into the substance and essence of body ‡, that the atoms of which each mass is composed are held together by a foreign force. If by chaos be meant matter, when this force is supposed to be removed, we must beg leave to say, that of such a substance we have neither idea nor notion, and cannot distinguish it from non-entity. The original atoms of matter, we believe indeed to require no other agency to keep each entire than that *fiat* by which it was created; but still, as those atoms are conceived to be solid and extended, they must be capable of division by infinite power; and if that *fiat* or influence which makes them solid and extended were removed, they would lose solidity and extension, and of course become nothing. So far is it, therefore, from being true, that the creation of matter appears to be impossible, that we are compelled by every thing that we know of it to believe that matter cannot possibly be self-existent.

‡ Baxter's Inquiry into the Nature of the Human Soul.

"Because it is undeniably certain, concerning ourselves (says Cudworth †), and all imperfect beings, that none of these can create any *new substance*, men are apt to measure all things by their own scantling, and to suppose it universally impossible for any power whatever thus to create. But since it is certain, that imperfect beings can themselves produce *some things* out of nothing pre-existing, as *new cogitations*, *new local motion*, and *new modifications* of things corporeal, it is surely reasonable to think that an absolutely perfect Being can do *something more*, *i. e.* create *new substances*, or give them their whole being. And it may well be thought as easy for God or an Omnipotent Being, to make a whole world, matter and all, ἐξ οὐκ ὄντων, as it is for us to create *a thought* or to move a finger, or for the sun to send out rays, or a candle light; or lastly, for an opaque body to produce an image of itself in a glass or water, or to project a shadow: all these imperfect things being but the *energies*, *rays*, *images*, or *shadows*, of the Deity. For a substance to be made out of nothing by *God*, or a *Being infinetely perfect*, is not for it to be made out of nothing in the impossible sense, because it comes from him who is *all*. Nor can it be said to be impossible for any thing whatever to be made by that which hath

† Intellectual System, Book i. Chap. 5.

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hath not only *infinitely greater perfection*, but also *infinite active power*. It is indeed true, that infinite power itself cannot do things in their own nature impossible; and, therefore, those who deny creation, ought to prove, that it is absolutely impossible for a *substance*, though not for an *accident* or *modification*, to be brought from non-existence into *being*. But nothing is in itself impossible, which does not imply a contradiction: and though it be a contradiction for a thing to be and not to be at the same time, there is surely no contradiction in conceiving an imperfect being, which before was not, afterwards to be." To call in question the possibility of creation, because we have no *adequate conception* how a thing can be brought into existence, would be in the highest degree absurd; for it may be doubted, whether we have *adequate* conceptions of any thing except our own ideas and their various relations (1).

305 God a free agent; but

The Being, which is self-existent, omnipotent, and omniscient, is not a *necessary*, but a *free* agent; for *active power* implies *freedom*, and *infinite* power *infinite* freedom. What, therefore, hath no bounds set to its power, what can have no opposition made to its will, nor restraint laid on its actions, must both will and act freely. "If the supreme cause were not a being endowed with liberty and choice, but a mere necessary agent, then would it follow, as Dr Clarke well observes †, that nothing which is not, could *possibly* have been; and that nothing which is, could *possibly* not have been; and that no mode or circumstance of the existence of any thing could *possibly* have been in any respect otherwise than it now actually is. All which being evidently most false and absurd; it follows, on the contrary, that the supreme cause is not a mere necessary agent, but a Being endued with liberty and choice."

† Demonstration of the Being and Attributes of God.

To this reasoning it has been lately replied †, that "Clarke must have known, that all those who contend against the free agency of the Deity, do of course acknowledge, that nothing could have happened, or does happen, or will happen, but what actually has happened, or doth happen, or will happen; and that it is most false and absurd to deny it." It is, therefore, according to the necessarians, absolutely impossible, that at present there could exist upon this earth more or fewer persons than are now actually alive; that the earth could move in any other direction than from west to east; or that there could be more or fewer planets in the solar system. Yet is it most certain, that there *have been fewer persons* on the earth than there are now; that there is not a cultivated country in Europe which could not contain *more* people than now inhabit it; that the comets move in very different directions from that of west to east; and that as, till very lately, we *conceived* only six primary planets in the system, it is evidently *possible* that the system *might contain* no more. Upon the supposition, therefore, that the Supreme Being acts under a physical necessity, the same things are possible and not possible at the same time, which is the grossest of all absurdities. It might have been objected with much more plausibility, that the first cause cannot possibly be free, because he must needs do always what is best in the whole; but it will be seen by and by, that among different created systems, there is no reason for supposing any one absolutely *best*.

† Cooper's Tracts.

306 himself unchangeable.

But though this Being is *free*, and as such the author of *change* in other beings, yet he must himself be *unchangeable*; for all changes have a beginning, and consequently are the effects of some *prior causes*. But there can be nothing prior to the existence of this Being, as he is *eternal*; neither any *cause* of it, as he is *independent*; nor consequently any *change* in it, except we could suppose him to *change himself*, which is the same absurdity as to *produce* himself, *i. e.* to be at *the same time both effect* and *cause*.

307 Omniscience, &c. proved in a different manner.

Omniscience, as well as some of the foregoing attributes of the Supreme Being, may perhaps be more easily deduced thus §. We find in ourselves such qualities as *thought* and *intelligence*, *power* and *freedom*, &c. for which we have the evidence of consciousness as much as for our own existence. Indeed, it is only by our consciousness of these that our existence is known to ourselves. We know likewise that these are *perfections*, and that to have them is better than to be without them. We find also that they have not been in us from eternity. They must, therefore, have had a *beginning*, and consequently some *cause* for the very same reason that a *being* beginning to exist in time requires a cause. Now this cause, as it must be *superior* to its *effect*, must have those perfections in a *superior* degree; and if it be the *first cause*, it must have them in an *infinite* or *unlimited* degree, since *bounds*, or *limitation* without a limiter, would as we have already shown, be an *effect* without a *cause*.

§ Notes to King on Evil.

It is indeed obvious, that the *omniscience* of the Supreme Being is implied in his very existence. "For all things being not only present to him, but also entirely

(1) "Ridicula foret et inepta ejus temeritas, qui corporum ideo creationem sibi duceret negandum esse, quod ejus creationis *clarum et perspicuum notionem* effingere cogitatione nobis haud licet. Infinita enim est rerum copia, quarum perspicuis et apertis caremus notionibus. Et si omnia neganda continuo nobis essent, quorum confusam tantam et imperfectam consequi possumus notionem, omnia fere nobis essent neganda exceptis *relationibus*, quos inter notiones quasdam abstractas esse intelligimus. Quis interiorem sibi naturam rerum, tam corporum, quam spirituum, cognitam esse dixerit? Et esse tamen has naturas, omni plane dubitatione vacat. Quis quemadmodum altera harum naturam agat in alteram, sese scire, affirmet? Quis causas sibi patere, propter quas hi vel illi effectus, quos videmus quotidie contingere, a certis veniant corporibus, jure glorietur? Nec tamen quisquam est, qui vel illam animæ in corpus operationem, vel hos effectus in dubium revocare ausit. Teneamus igitur ea, quæ certo novimus, nec idcirco nos ab illis dimoveri patiamur, quod multa rursus sunt, quorum naturam ignoramus; contra multa nos fugere et cognitionem nostram superare, æquo et tranquillo feramus animo. *Joannis Clerici contra eos qui negant, ex nihilo ulla ratione fieri posse aliquid, observationes; in Mosheimii edit. Intellec. Syst.*

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tirely *depending* upon him, and having *received* both their *being* itself and all their powers and faculties *from him*, it is manifest that as he knows all things that are, and penetrates every part of their substance with his all-seeing eye, so must he likewise know *all possibilities* of things, that is, all effects that *can be*. For, being alone self-existent, and having alone given to all things all the powers and faculties with which they are endued, it is evident that he must of necessity know perfectly what all and each of these powers and faculties, *which are derived wholly from himself*, can possibly produce. And seeing at one boundless view, or more properly in his own ideas, all the possible compositions and divisions, variations and changes, circumstances and dependencies of things, all their possible relations one to another, and their dispositions or fitnesses to certain and respective ends, he must without possibility of error know exactly what is best and propereſt in every one of the numberless possible cases, or methods of disposing things; and understand perfectly how to order and direct the respective means to bring about what he so knows to be in its kind, or on the whole, the best and fittest in the end. This is what is meant by infinite wisdom, or omniscience † ;" and it has been readily admitted by every man who has believed in the existence of a God as the creator and preserver of all things.

† Clarke's Demonstration, &c.

308 God foreknows the actions of free agents.

Doubts, however, have been entertained by theists, and pious theists, whether omniscience itself can certainly foreknow what are called contingent events, such as the actions of free agents; and some few there are professing to be even Christians, who have boldly pronounced such knowledge to be impossible. That we have no adequate notion *how* events, which are called contingent, can be certainly foreknown, must indeed be granted; but we are not, therefore, authorised to say that such knowledge is impossible, unless it can be clearly shown to imply a contradiction. They who suppose that it implies a contradiction, must likewise suppose, that, where there is not a chain of necessary causes, there can be no certainty of any future event; but this is evidently a mistake. "For let us suppose that there is in man a power of beginning motion, and of acting with what has of late been called *philosophical* freedom; and let us suppose farther that the actions of such a man cannot possibly be foreknown; will there not yet be in the nature of things, notwithstanding this supposition, the same *certainty of event* in every one of the man's actions, as if they were ever so fatal and necessary? For instance, suppose the man, by an internal principle of motion, and an absolute freedom of mind, to do some particular action *to-day*, and suppose it was not possible that this action should have been foreseen *yesterday*, was there not nevertheless the same *certainty of event* as if it had been foreseen, and absolutely necessary? That is, would it not have been as *certain a truth* yesterday, and from eternity, that this action was in event *to be performed to-day*, notwithstanding the supposed freedom, as it is now a *certain and infallible truth* that it is performed? Mere *certainty of event*, therefore, does not in any measure imply *necessity* †." And surely it implies no contradiction to suppose, that every future event which in the nature of things is *now certain*, may *now be certainly known* by that intelligence which is omniscient. The *manner* how God can foreknow future events, without a *chain of necessary causes*, it is indeed impossible for us to explain: yet some sort of *general notion* of it we may conceive. "For, as a man who has no influence over another person's actions, can yet often perceive beforehand what that other will do; and a wiser and more experienced man, with still *greater probability* will foresee what another, with whose disposition he is perfectly acquainted, will in certain circumstances do; and an angel, with still *less degrees of error*, may have a further prospect into mens future actions: so it is very reasonable to conceive, that God, without influencing mens wills by his power, or subjecting them to a chain of necessary causes, cannot but have a knowledge of future free events, as much *more certain* than men or angels can possibly have, as the *perfection* of *his* nature is greater than that of *theirs*. *The distinct manner how* he foresees these things we cannot, indeed, explain; but neither can we explain the *manner* of numberless other things, of the reality of which, however, no man entertains a doubt †." We must therefore admit, so long as we perceive no contradiction in it, that God always knows all the free actions of men, and all other beings endued with liberty; otherwise he would know many things now of which he was once ignorant, and consequently his *omniscience* would receive addition from events, which has been already shown to be contrary to the true notion of infinity.—In a being incapable of change, knowledge has nothing to do with *before* or *after*. To every purpose of knowledge and power, all things are to him equally present. He knows perfectly every thing that is, and what to us is future he knows in the very same manner as he knows what to us is present.

† Clarke's Demonstration, &c.

309 God infinitely perfect, all-sufficient, and omnipresent.

Thus have we demonstrated the necessary existence of a being who is *eternal*, *independent*, *unchangeable*, *omnipotent*, *free in his actions*, and *omniscient*; and this is the being whom we worship as God. *Eternity*, *independence*, *immutability*, *omnipotence*, *liberty*, and *omniscience*, which seem to be all the *natural* attributes which we can discover in the divine nature, as they are conceived to be differently combined, made us speak of him in different terms. His enjoying in an absolute manner every conceivable power or perfection, makes us call him a Being *infinitely perfect*. His being capable of no want, defect, or unhappiness of any kind, denotes him to be *all-sufficient in himself*; and the unlimited exercise of his knowledge and power, demonstrates him to be *omnipresent*. That such a Being must be incomprehensible by us, and by every creature, is a truth self-evident; and yet in all ages men of the best intentions have been vainly attempting this impossibility. The manner of his omniscience, for instance, has been the subject of much disputation among those who ought to have reflected that they knew not how their own minds were present to their own bodies.—The celebrated Dr Clarke and his adherents, who considered space as the *sine qua non* of all other things, insisted, that God must be infinitely extended; and that, as wherever his substance is, there his attributes must be, it is thus that his knowledge and power are present with every creature. But this notion labours under insuperable difficulties.

For "if the Divine substance be infinitely extended, then will there be part of it in this place and part in

† Clarke's Demonstration, &c.

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310 The manner of the Divine Omnipresence incomprehensible.

in that. It must be commensurate with all particular beings, so that some will occupy more and some less of its dimensions. By this account it will be very proper and philosophical to say, that God is not in *heaven*, but only a *part* of him; and that an *elephant* or a *mountain*, a *whale* or a wicked *giant*, have more of the essence or presence of God with them than the *holiest* or *best* man in the world, unless he be of equal size: all which, as has been well observed †, are at least harsh and grating expressions. As the attributes of the Divine Being must be considered in the same manner with his substance, we shall likewise, upon this notion of omnipresence, have a part of his knowledge and power in this place, and a part of them in that; and of these parts the one must be greater or less than the other according to the dimensions of the place with which it is commensurate; which is a supposition that appears to us harsher, if possible, than even the former.

† Watt's Essays, and Law's Inquiry into the Ideas of Space, Time, and Immensity, &c.

"Should it be said that the Divine attributes are not to be considered as having parts (though we see not how they can be considered otherwise than as their subject), they must then exist *completely* in every point of this immense expansion. Be it so; and what follows? Why, every point of this infinitely expanded being will be omniscient and omnipotent by itself; an inch of it will have as much wisdom and power as a yard, a mile, or the whole; and, instead of one infinite wisdom and power, we shall have millions: For as these parts of the substance are conceived, *distinctly*, and one individual part is not another, so must the attributes be likewise conceived, and the individual power and knowledge of one part be distinct from that of another." And if so, it follows, that one point of this expanded being has equal power and intelligence with the whole; so that the notion of extension being *necessary* to God's presence with every creature, involves in it the most palpable contradiction. That God is at all times and in all places so present with every creature as to have an absolute knowledge of and power over it, is indeed capable of the strictest demonstration; but we think it great presumption to assign the particular *mode* of his presence, especially such a one as is neither agreeable to the nature of an absolutely perfect Being, nor in the least necessary to the exercise of any one perfection which he can be proved to possess. Philosophers and divines have offered several names for the manner in which God is present with his works; but we choose rather to confess, that the *manner* of his presence is to us, and probably to every creature, wholly incomprehensible. Nor need we be surprised or staggered at this, when we reflect that the manner in which our own minds are present with our bodies is to us as incomprehensible as the manner in which the supreme Mind is present with every thing in the universe. That our minds have a power over our limbs, we know by experience: but that they are not extended or substantially diffused through them, is certain; because men daily lose arms and legs without losing any part of their understanding, or feeling their energies of volition in the smallest degree weakened. But we need pursue this subject no farther. It has been confessed by one of the most strenuous advocates ‡ for the extension of the Deity and all minds, that "there is an incomprehensibleness in the *manner* of every thing, about which no controversy can or ought to be concerned."

‡ Mr Jackson's Existence and Unity, &c. page 110.

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311 God's moral attributes result from his natural perfections.

The moral attributes of God may be deduced from his natural ones, and are immediate consequences of them when exercised on other beings. They may be termed his *secondary relative* attributes, as they seem to be the perfection of his *external acts* rather than any *new internal* perfections. And though the existence of any moral quality or action is not capable of strict *demonstration*, because every moral action or quality, as such, depends upon the *will* of the agent, which must be absolutely free; yet we have as great assurance that there are moral qualities, in God, and that he will always act according to these qualities, as the nature of the thing admits; and may be as well satisfied of it, as if it were capable of the most rigid demonstration. This important point, however, cannot be so clearly or so firmly established by abstract reasoning as by taking a scientific view of the works of creation, which evince the goodness, holiness, and justice, of their Author, as well as his perfect wisdom and infinite power. The consideration, therefore, of the moral attributes of God, together with his providence, and the duties thence incumbent on man, is the proper business of other articles (see RELIGION, THEOLOGY, and MORAL *Philosophy.*)

312 How they ought to be conceived.

At present we shall only observe, that by reasoning *à priori* from his existence and his natural perfections, we must necessarily infer that his actions are the result of unmixed benevolence. Every wise agent has some end in view in all his actions; it being the very essence of folly to act for no end: but there cannot be an end of action which is not either selfish or benevolent. Selfishness is the offspring of want and imperfection, and is therefore the source of most *human* actions; because men are weak and imperfect beings, capable of daily additions to their happiness When the thief plunders a house at midnight, when the highwayman robs a traveller on the road, and even when the assassin murders the man who never injured him: it will be found that their actions spring not from an innate desire to inflict misery upon others, but from a prospect of reaping advantage to themselves. The object of the thief and the robber is obvious: it is to gain money, which is the mean of procuring the comforts of life. Even the assassin has always the same selfish end in view: either he is bribed to commit the murder, or he fancies that his horrid deed will remove an *obstacle* from the way to his own happiness. But they are not vicious men *only* who act from selfish considerations: much of human *virtue*, when traced to its source, will be found to have its origin in the desire of happiness. When a man gives his money to feed the hungry and to clothe the naked, he believes that he is acting agreeably to the will of Him to whom he and the poor stand in the same relation; and he looks for a future and eternal reward. By continuing the practice, he soon acquires the habit of benevolence; after which, indeed, he looks for no further reward, when performing particular actions, than the immediate pleasure of doing good. This selfishness of man is the necessary consequence of his progressive state. But the Being who is independent, omnipotent, omniscient, and, in a word, possessed of every possible per-

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perfection, is incapable of progression, or of having any accession whatever made to his happiness. He is immutable; and must of necessity have been as happy from eternity, when existing alone, as after the creation of ten thousand worlds. When, therefore, he willed the existence of other beings, he could have nothing in view but to communicate some resemblance of his own perfections and happiness. That he had *some* end in view follows undeniably from his infinite wisdom. That he could not have a *selfish* end, follows with equal certainty from his own infinite perfections; and as there is no medium, in the actions of a wise Being, between selfishness and benevolence, we must necessarily conclude, that the creation was the result of unmixed benevolence or perfect goodness. The other moral attributes of the Deity, his justice, mercy, and truth, ought therefore to be considered only as so many different views of the same *goodness* in the *Creator*, and various sources of *happiness* to the *creature*. These are always *subordinate* to and *regulated* by this one principal perfection and brightest ray of the Divinity.

"Thus we conceive his *justice* to be exerted on any being no farther than his goodness necessarily requires, in order to make that being, or others, *sensible* of the *henious nature* and *pernicious effects of sin* †, and thereby to bring them to as great a degree of happiness as their several natures are capable of. His *holiness* hates and abhors all wickedness, only as the necessary consequences are absolute and unavoidable misery; and his veracity or faithfulness seems to be concerned for truth, only because it is connected with, and productive of the happiness of all rational beings; to provide the properest means for attaining which great end is the exercise of his *wisdom*." Such is the view of God's moral attributes, which the abstract contemplation of his natural perfections necessarily gives; and whether this way of conceiving them be not attended with less difficulty than the common manner of treating them under the notion of two infinites *diametrically opposite*, must be left to the judgment of the reader.

† Notes to King on Evil.

313 The origin of evil.

But if the Creator and supreme Governor of all things be a Being, of infinite power, perfect wisdom, and pure benevolence, how came evil into the works of creation? This is a question which has employed the speculative mind from the first dawning of philosophy, and will continue to employ it till our faculties be enlarged in a future state, when philosophy shall give place to more perfect knowledge. To these meditations, as has been well observed ‡, humanity is not equal. Volumes have been written on the subject; but we believe that the following extract from Dr Clarke contains all that can be advanced with certainty and all that is necessary to vindicate the ways of God to man.

‡ Johnson's Review of a free Inquiry into the Origin of Evil.

‖ Demonstration of the Being and Attributes of God.

"All that we call evil (says that able reasoner ‖), is either an *evil of imperfection*, as the want of certain faculties and excellencies which other creatures have; or *natural evil*, as pain, death, and the like; or *moral evil*, as all kinds of vice. The *first* of these is not properly an evil: for every power, faculty, or perfection, which any creature enjoys, being the free gift of God, which he was no more obliged to bestow than he was to confer being or existence itself, it is plain, that the want of any certain faculty, or perfection, in any kind of creatures, which never belonged to their nature, is no more an evil to them, than their never having been created or brought into being at all could properly be called an evil." To this we may add, that as no created being can be self-existent and independent, imperfection is unavoidable in the creation, so that the evil of defect (as it is most absurdly called) must have been admitted, or nothing could ever have existed but God. "The *second* kind of evil, which we call *natural* evil, is either a necessary consequence of the former, as *death* to a creature on whose nature immortality was never conferred; and then it is no more properly an evil than the former: Or else it is counterpoised in the whole with as great or greater good, as the *afflictions and sufferings of good men*; and then also it is properly no evil: Or else it is a *punishment*; and then it is a necessary consequence of the *third* and last sort of evil, viz. *moral evil*. And *this* arises wholly from the abuse of *liberty*, which God gave to his creatures for other purposes, and which it was reasonable and fit to give them for the perfection and order of the whole creation: only they, contrary to God's intention and command, have abused what was necessary for the perfection of the whole, to the corruption and depravation of themselves. And thus have all sorts of evils entered into the world without any diminution to the infinite goodness of its Creator and Governor."

314 Whether the present be the best system possible.

But though evil could not be totally excluded from the universe, are we not authorised to infer, from the infinite power, wisdom, and goodness of the Creator, that the present system is upon the whole the very best system possible? Undoubtedly we are, if of possible systems there *can be a best*; but this is so far from being evident, that we think it implies a contradiction. A best of beings there is, *viz.* God, who is possessed of infinite perfections; but there cannot be a best of creatures or of created systems. To prove this, we need only reflect, that wherever creation stops, it must stop infinitely short of infinity; and that how perfect soever we conceive any creature or system of creatures to be, yet the distance between that and God is not lessened, but continues infinite. Hence it follows, that the nature of God and his omnipotence is such, that whatever number of creatures he has made, he may still add to that number, and that however good or perfect the system may be on the whole, he might still make others equally good and perfect.

315 Origin of that question.

The dispute, whether a being of infinite power, wisdom, and benevolence, must be supposed to have created the *best possible system*, and the embarrassment of men's understandings about it, seem to have arisen from their taking the words *good*, *better*, and *best*, for absolute qualities inherent in the nature of things, whereas in truth they are only relations arising from certain appetites. They have indeed a foundation, as all relations have, in something absolute, and denote the thing in which they are founded; but yet they themselves imply nothing more than a relation of congruity between some appetite and its objects. This is evident; because the same object, when applied to an appetite to which it has a congruity, is good; and bad, when applied to an appetite to which it has no congruity. Thus, the earth and air to terrestrial animals are good elements, and necessary to their preservation: to those animals the water is bad, which yet affords

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affords the best receptacle to fishes. *Good*, therefore, being relative to appetite, that must be reckoned the best creature by us which has the strongest appetites, and the surest means of satisfying them all, and securing its own permanent happiness. And though the *substance* of creatures is chiefly to be regarded as contributing to their perfection, yet we have no way of measuring the perfection of different substances but by their qualities, *i. e.* by their appetites by which they are sensible of good and evil, and by their powers to procure those objects from which they receive that sense of things which makes them happy.

316 No system absolutely best.

It is plain, therefore, that whatever system we suppose in nature, God might have made another equal to it; his infinite wisdom and power being able to make other creatures equal in every respect to any that we know or can conceive, and to give them equal or stronger appetites, and as certain or more certain ways of satisfying them. We see in many cases, that very different means will answer the same end. A certain number of regular pyramids will fill a space; and yet irregular ones will do it as well, if what we take from the one be added to another; and the same thing may be done by bodies of the most irregular and different figures in the same manner: and therefore we may very well conceive, that the answering of appetites, which is all the *natural good* that is in the world, may as well be obtained in another system as in this; provided we suppose, that where the appetites of the sentient beings are changed, the objects are also suited to them, and an equal congruity among the parts of the whole introduced. This is so easily conceived, that in an indefinite number of possible worlds, we do not see why it may not be done in numberless ways by infinite power and wisdom.

If then it be plain, that there might have been many other worlds, or even but one, equal to this in all respects as to goodness, there could be no necessity, either physical or moral, that God should create the one rather than the other; because nothing could make the one better, or to him more agreeable, than the other, but his own free choice. Either, therefore, God must be possessed of absolute freedom, or, among a number of possibilities equally perfect, he could not have made a choice, and so nothing would ever have been created. It is not, then, as Leibnitz and others argue, the natural and necessary goodness of some particular things, *represented by the divine ideas*, which determines God to prefer them to all others, if understood of his *first* act of producing them; but it is his own free choice, which among many equal *potential* goods, makes some things *actually* good, and determines them into existence. When these are once supposed to exist, every thing or action becomes good which tends to their happiness and preservation; and to suppose their all-perfect Author to have any other end in view than their preservation and happiness, is the same absurdity as to suppose that knowledge may produce ignorance; power, weakness; or wisdom folly.

317 God not necessitated by his goodness to create the present in preference to all other worlds.

We have now finished what we proposed under the article Metaphysics. It has swelled in our hands to a large extent; and yet it can be considered as little more than an introduction to that science, which comprehends within its wide grasp every thing existing. The reader who wishes to pursue these interesting speculations, should study diligently the authors whom we have consulted, and to whom we have been careful to refer in the margin. Were we to make a selection, we should without hesitation recommend Aristotle and Plato among the ancients; and Cudworth, Locke, Hartley, and Reid, among the moderns. These philosophers, indeed, on many points, differ exceedingly from one another; but he who wishes not to adopt opinions at random, should know what can be said on both sides of every question.

Metaplasmus | Metastasio.

METAPLASMUS, in grammar, a transmutation or change made in a word, by adding, retrenching, or altering a syllable or letter thereof.

METAPONTUM, or METAPONTIUM, (anc. geog.), a town of Lucania, on the Sinus Tarentinus, to the west of Tarentum; built by the Pylians, who returned from Troy, (Mela.) Where Pythagoras is said to have taught in the time of Servius Tullius, (Livy). *Metapontini*, the people; who pretended to show, in a temple of Minerva, the tools with which Epeus built the wooden horse, (Justin). Now a tower, called *Torre di Mare*, in the Basilicata of Naples, (Baudrand.)

METASTASIO (l' abbe Pierre Bonaventure), whose real name was *Trapassi*, was born at Assise, on January 3d, 1698. His talent for poetry was first unfolded by the reading of Tasso; and he began to compose verses at ten years of age. "A prodigy of this nature (says Metastasio) made such an impression on my master, the celebrated Gravina, that he thenceforth considered me as a plant worthy of being cultivated by his own hands." Metastasio was only fourteen years of age when he composed his tragedy entitled *Il Giustino;* in which he appears too close and scrupulous an imitator of the Grecian drama. Our young poet unfortunately lost his patron in 1717; who left him his heir, "as being a young man of the most promising abilities." Metastasio, at the age of nineteen, being, in consequence of this inheritance, superior to those wants which repress the exertions of genius, and to which men of abilities are too often subject, gave full scope to his inclination for poetry. He began his dramatic career with the *Didonne Abandonnata*, which was acted at Naples in 1724; the music was composed by Sarro. He soon acquired such celebrity, that in 1729 he was invited to Vienna by the emperor Charles VI.; who appointed him imperial poet, and granted him a pension of 4000 florins. From that time some of his works were presented at every court-festival; and notwithstanding the extreme magni-

magnificence of these entertainments, they should now be forgotten were it not for the verses which he composed upon the occasion. The courts of Vienna and Madrid vied with each other in the presents which they conferred upon him. From Maria Theresa he received a snuff-box and a port-folio set with diamonds, and a golden candlestick with a screen. Ferdinand VI. king of Spain, informed of the great merit of Metastasio by Farinelli, of whom he was a passionate admirer, sent him a present of a casket mounted with gold, and furnished with the different implements of writing. This favourite of kings and of the muses was of a cheerful temper, and was exceedingly temperate: to this he was probably indebted for the uninterrupted health which he enjoyed, and for the entire possession of his senses and faculties to the most advanced period of old-age. He took his meals, arose, and went to bed, always at stated hours. This exactness and order were scrupulously observed even in the most trifling actions of his life. He used to say in jest, that he dreaded hell for no other reason but because it was a place *ubi nullus ordo, sed sempiternus horror inhabitat*. He had even his stated hours for making verses; to which he scrupulously adhered, without waiting for the moment of poetical enthusiasm. He was equally regular in the duties of the Christian as in the labours of the scholar. His behaviour was that of a true philosopher: his ambition extended no farther than the attainment of literary fame; and he despised every civil mark of distinction. When Charles VI. offered him the titles of *Count* or of *Baron*, which add no real worth or dignity to the possessor, but frequently make him appear in a more ridiculous light, he instantly begged the favour that he would allow him still to continue *Metastasio*. The empress Maria Theresa afterwards wished to bestow upon him the small cross of St Stephen; but he excused himself on account of his age, which would prevent him from assisting at the festivals of the order. He was attacked by a fever on the 2d of April 1782; and he died on the 12th of the same month, at the age of 84. Before his death he received the sacrament according to the form of the Romish church; and Pius VI. who was then at Vienna, sent him his apostolical benediction *in articulo mortis*. He left about 150,000 florins. He composed a great number of tragic operas, and several small dramatic pieces which have been set to music. We have different editions of them in 4to, 8vo, and 12mo; and M. Richelet has published a translation of them into French, in 12 vols, small 12mo.

The greatest part of Metastasio's writings will confer immortality on their author. His dialogue is natural, simple, and easy; his style is always pure and elegant, and sometimes sublime and pathetic. His subjects are noble, interesting, and excellently adapted for representation. He was perfectly acquainted with the resources of his art, and has subjected the opera to rules. He stripped it of its machinery, and of the marvellous, which was fitted to excite the gaze of astonishment, but which gave no instruction to the understanding, and made no impression on the heart. His descriptions are copied from nature; the situations of his characters never fail to raise an interest in the reader, and often excite the tear of pity. His fables are celebrated; his characters are noble and well supported; his plots are excellently conducted, and happily unravelled. "There are scenes (says Voltaire) worthy of Corneille when he does not declaim, and of Racine when he is not feeble." His operas, in point of the pathetic, may be compared with our finest tragedies; and may be read with great pleasure, independent of the charms of the music. We must not, however, expect to find in Metastasio that exact regularity, and that fertile simplicity, which constitutes the excellence of some of our tragic poets: But though he sometimes transgresses the unities of time and place, he always preserves the unity of interest. Notwithstanding all these advantages, some critics will not allow him the merit of invention, which is the first qualification of a poet. They consider him only as a successful imitator of the French tragic writers, from whom a great part of his beauties are borrowed, and place him at the head of the finest wits of Italy, but deny that he possessed genius. He was a fond admirer of the ancients; and this admiration, increasing with the solidity of his understanding, continued to the last period of his life. He recommended reading them, as he himself had done, in a chronological order. His memory was excellent, and continued unimpaired even in old age. Horace was his favourite author, and he could repeat almost the whole of him. Metastasio, who, as we have observed, was the pupil of the celebrated Gravina, added a gentleness of character peculiar to himself to the accuracy of thinking and great erudition of his master. His abilities and fame were respected by the critics in general; and whereas the life of most men of letters is one continued warfare, his days happily glided away in tranquillity and peace. The circumstance which occasioned the change of his name is thus related in a late anecdote: "Gravina's barber, who, like most of his profession, was a great talker, one day informed him, that in the *Place de la Valicella*, where he had his shop, a young boy came every evening, and sung extempore verses of his own composition, so harmonious and elegant that all the passengers stopped to listen to them. Gravina, upon this information, added one to the number of the young poet's audience, and found the verses so superior to the idea which he had formed of them from the account of the barber, and so much above the capacity of a child of ten or eleven years of age, that he instantly determined to undertake the cultivation of so promising a plant. His first care was to put the young *Trapassi* (which was the boy's name) to school; but apprehending that the ordinary methods of education might check the progress of so uncommon talents, he took him home to his own house, and changed his name into *Metastasio*, which signifies the same thing in Greek. In short, by a plan of education and by instruction suited to his genius, Gravina laid the foundation of that reputation which he predicted, and which Metastasio now enjoys." *Vies des Hommes Illustres d' Italie, Tom.* I. *p.* 187.

METASTASIS, in medicine, a transposition or settlement of some humour or disease in some other part; and sometimes it signifies such an alteration of a disease as is succeeded by a solution.

METATARSUS (*μετα beyond*, and *ταρσος the tarsus*), in anatomy, that part of the human skeleton containing

Metathesis, Metelin.

containing the midldle of the foot. See ANATOMY, n° 70.

METATHESIS, in grammar, a species of the metaplasmus; being a figure whereby the letters or syllables of a word are transposed, or shifted out of their usual situations, as *pistris* for *pristis*, *Lybia* for *Libya*, &c.

This word is, by physicians, used with respect to morbific causes, which, when they cannot be evacuated, are removed to places where they are less injurious.

METELIN, the modern name of the Island of Lesbos. See LESBOS and MITYLENE.

In the Irish Philosophical Transactions for 1789, we have a description of this island by the earl of Charlemont, in which he speaks in Raptures of its beauties. "The mountains, whose rugged tops exhibit a pleasing interspersion of rocks and fine groves, have their green sides, for many miles along the coast, covered with olives, whose less agreeable verdure is corrected, embellished, and brightened by a lively mixture of bays and laurels aspiring to the height of forest trees, of myrtles and pomegranates, of arbutes rich at once in blossom and in berry, of mulberries growing wild and laden with fruit, &c. Winter is here unknown, the verdure is perpetual, and the frequency of evergreens gives to December the colour of June. The parching heat of summer is never felt; the thick shade of trees, and thousands of crystal springs which every where arise and form themselves into unnumbered rivulets, joined to the refreshing sea-breezes the constant corrective and companion of noon tide heat, qualify the burning air and render the year a never-ending May. The houses are constructed in such a manner as to have the best view of these natural beauties. Each is a square tower neatly built of hewn stone, so high as to overtop the trees, and to command a view of the sea and neighbouring islands. The lower stories are granaries and storehouses; and the habitable apartments are all at top, to which you ascend by a stone stair, built for the most part on the outside, and surrounding the tower; so that from the apartment the trees are overlooked, and the whole country is seen, while the habitations themselves, which are very numerous, appearing above the groves, add life and variety to the enchanting prospect, and give an air of human population to these woodlands, which might otherwise be supposed the region of Dryads, of Naiads, and of Satyrs."

The most remarkable thing however, in this island is a custom by which the women have here openly usurped those rights of sovereignty which in other countries are supposed to belong essentially to the men. "Contrary (says his lordship) to the usage of all other countries, the eldest daughter here inherits; and the sons, like daughters every where else, are portioned off with small dowers, or, which is still worse, turned out pennyless to seek their fortune. If a man has two daughters, the eldest at her marriage, is intitled to all her mother's possessions, which are by far the greater part of the family estate, as the mother, keeping up her prerogative, never parts with the power over any portion of what she has brought into the family, until she is forced into it by the marriage of her daughter; and the father also is compelled to ruin himself by adding whatever he may have scraped together by his industry. The second daughter inherits nothing, and is condemed to perpetual celibacy. She is styled a *calogria*, which signifies properly a religious woman or nun, and is in effect a menial servant to her sister, being employed by her in any office she may think fit to impose, frequently serving her as waiting-maid, as cook, and often in employments still more degrading. She wears a habit peculiar to her situation, which she can never change; a sort of monastic dress, coarse, and of a dark brown. One advantage, however, she enjoys over her sister, that whereas the elder, before marriage, is never allowed to go abroad, or to see any man, her nearest relations only excepted, the calogria, except when employed in domestic toil, is in this respect at perfect liberty. But when the sister is married, the situation of the poor calogria becomes desperate indeed, and is rendered still more humiliating by the comparison between her condition and that of her happy mistress. The married sister enjoys every sort of liberty; the whole family fortune is hers, and she spends it as she pleases; her husband is her obsequious servant, her father and mother are dependent upon her, she dresses in a most magnificent manner, covered all over, according to the fashion of the island, with pearls and with pieces of gold, which are commonly sequins; thus continually carrying about her the enviable marks of affluence and superiority, while the wretched calogria follows her as a servant, arrayed in simple homespun brown, and without the most distant hope of ever changing her condition. Such a disparity may seem intolerable, but what will not custom reconcile? Neither are the misfortunes of the family yet at an end. The father and mother, with what little is left them, contrive by their industry to accumulate a second little fortune; and this, if they should have a third daughter, they are obliged to give to her upon her marriage; and the fourth, if there should be one, becomes her calogria; and so on through all the daughters alternately. Whenever the daughter is marriageable, she can by custom compel the father to procure her a husband; and the mother, such is the power of habit, is foolish enough to join her in teasing him into an immediate compliance, though its consequences must be equally fatal and ruinous to both of them. From hence it happens, that nothing is more common than to see the old father and mother reduced to the utmost indigence, and even begging about the streets, while their unnatural daughters are in affluence; and we ourselves have frequently been shown the eldest daughter parading it through the town in the greatest splendor, while her mother and sister followed her as servants, and made a melancholy part of her attendant train.

"The sons, as soon as they are of an age to gain a livelihood, are turned out of the family, sometimes with a small present or portion, but more frequently without any thing to support them; and thus reduced, they either endeavour to live by their labour, or, which is more usual, go on board some trading vessel as sailors, or as servants, remaining abroad till they have got together some competency, and then return home to marry and to be henpecked. Some few there are who, taking advantage of the Turkish law, break through this whimsical custom, who marry their calogrias, and

retain to themselves a competent provision: but these are accounted men of a singular and even criminal disposition, and are hated and despised as conformists to Turkish manners, and deserters of their native customs; so that we may suppose they are few indeed who have the boldness to depart from the manners of their country, to adopt the customs of their detested masters, and to brave the contempt, the derision, and the hatred, of their neighbours and fellow-citizens.

"Of all these extraordinary particulars I was informed by the French consul, a man of sense and of indisputable veracity, who had resided in this island for several years, and who solemnly assured me that every circumstance was true: but indeed our own observation left us without the least room for doubt, and the singular appearance and deportment of the ladies fully evinced the truth of our friend's relation. In walking through the town, it is easy to perceive, from the whimsical manners of the female passengers, that the women, according to the vulgar phrase, *wear the breeches*. They frequently stopped us in the streets, examined our dress, interrogated us with a bold and manly air, laughed at our foreign garb and appearance; and showed so little attention to that decent modesty which is or ought to be the true characteristic of the sex, that there is every reason to suppose they would, in spite of their haughtiness, be the kindest ladies upon earth, if they were not strictly watched by the Turks, who are here very numerous, and would be ready to punish any transgression of their ungallant laws with arbitrary fines. But nature and native manners will often baffle the efforts even of tyranny. In all their customs these manly ladies seem to have changed sexes with the men. The woman rides astride, the man sits sideways upon the horse; nay, I have been assured that the husband's distinguishing appellation is his wife's family name. The women have town and country houses, in the management of which the husband never dares interfere. Their gardens, their servants, are all their own; and the husband, from every circumstance of his behaviour, appears to be no other than his wife's first domestic, perpetually bound to her service, and slave to her caprice. Hence it is that a tradition obtains in the country, that this island was formerly inhabited by Amazons; a tradition, however, founded upon no ancient history that I know of. Sappho indeed, the most renowned female that this island has ever produced, is said to have had manly inclinations; in which, as Lucian informs us, she did but conform with the singular manners of her countrywomen: but I do not find that the mode in which she chose to show these inclinations is imitated by the present female inhabitants, who seem perfectly content with the dear prerogative of absolute sway, without endeavouring in any other particular to change the course of nature; yet will this circumstance serve to show, that the women of Lesbos had always something peculiar, and even peculiarly masculine, in their manners and propensities, But be this as it may, it is certain that no country whatsoever can afford a more perfect idea of an Amazonian commonwealth, or better serve to render probable those ancient relations which our manners would induce us to esteem incredible, than this island of Metelin. These lordly ladies are for the most part very handsome in spite of their dress, which is singular and disadvantageous. Down to the girdle, which as in the old Grecian garb is raised far above what we usually call the waist, they wear nothing but a shift of thin and transparent gauze, red, green, or brown, through which every thing is visible, their breasts only excepted, which they cover with a sort of handkerchief; and this, as we were informed, the Turks have obliged them to wear, while they look upon it as an incumbrance, and as no inconsiderable portion of Turkish tyranny. Long sleeves of the same thin material perfectly show their arms even to the shoulder. Their principal ornaments are chains of pearl, to which they hang small pieces of gold coin. Their eyes are large and fine; and the nose, which we term Grecian, usually prevails among them, as it does indeed among the women of all these islands. Their complexions are naturally fine; but they spoil them by paint, of which they make abundant use; and they disfigure their pretty faces by shaving the hinder part of the eyebrow, and replacing it with a straight line of hair neatly applied with some sort of gum, the brow being thus continued in a straight and narrow line till it joins the hair on each side of their face. They are well made, of the middle size, and for the most part plump; but they are distinguished by nothing so much and so universally as by a haughty, disdainful, and supercilious air, with which they seem to look down upon all mankind as creatures of an inferior nature, born for their service, and doomed to be their slaves; neither does this peculiarity of countenance in any degree diminish their natural beauty, but rather adds to it that sort of bewitching attraction which the French call *piquant*."

His lordship has been at great pains to investigate the origin of such a singular custom; but is unable to find any other example in history than that of the Lycians, who called themselves by the names of their mothers, and not of their fathers. When asked by their neighbours who they were? they described themselves by their maternal genealogy. If a gentlewoman should marry a slave, the children by that marriage were accounted noble; but should the first man among them marry a foreign woman, the children would be accounted ignoble. This custom is mentioned by several ancient authors. A difficulty of no little magnitude occurs, however, in accounting for the derivation of the inhabitants of Lesbos from the Lycians. This is solved in the following manner: In times of the most remote antiquity, the island of Lesbos was peopled by the Pelasgi, who, under their leader Panthus, the son of Triopas king of Argos, first inhabited Lesbos: previous to that time they had dwelt in a certain part of Lycia which they had conquered; and in this country we may suppose they had learned the custom in question. But though this might readily be granted, as we know so little of the origin of ancient nations, yet the question still recurs, Whence did it originate among the Lycians? Here we are still more difficulted than before; and the only thing we have to help us out is an obscure tradition concerning Bellerophon, *viz.* that the hero having destroyed a boar which wasted the territory of Xanthus a city of Lycia, the inhabitants were so ungrateful as to return him no thanks for so great a favour; upon which, by his prayers, he caused the curse of barrenness to fall upon them, but was at length

length prevailed upon, by the intreaties of the women, to intercede with his patron Neptune to pardon them. On this account it was decreed, that the people of Xanthus should be called by the names of their mothers and not of their fathers. Plutarch relates also, that Bellerophon not only freed the Lycians from an invasion of pirates, but from the Amazons also, whom he drove out of their country; "so that there may be some reason (says his Lordship) to suppose, that the Lycian women, by an intecrourse with the Amazons, who had, it should seem, dwelt among them, were already previously prepared for the introduction of those customs, which were finally established in consequence of their patriotic merit in deprecating the wrath of Bellerophon, and in averting its fatal consequences."

This is the substance of what his Lordship advances to the origin of this extraordinary custom. He owns, that the traces are very obscure; and though he is conscious that such a speculation may be liable to ridicule, and he is aware "of some objections not easy to be answered, the coincidence will notwithstanding be allowed to be curious and very remarkable. The well known pertinacious adherence to ancient manners among the eastern nations, may in some measure excuse our credulity; and we may still add to our authority, by supposing that this same Xanthus may probably have given his name to the Lycian city of that denomination; and consequently must have inhabited that very part of Lycia where, according to Plutarch, he is supposed more immediately to have flourished."

METELLUS, the surname of the family of the Cæcilii at Rome, the most known of whom were ——A general who defeated the Achæans, took Thebes, and invaded Macedonia, &c.—Q. Cæcilius, who rendered himself illustrious by his successes against Jugurtha the Numidian king, from which he was surnamed *Numidicus*.—Another who saved from the flames the palladium, when Vesta's temple was on fire. He was then high-priest. He lost his sight and one of his arms in the action; and the senate, to reward his zeal and piety, permitted him always to be drawn to the senate-house in a chariot, an honour which no one had ever before enjoyed. He also gained a great victory over the Carthaginians, &c.—Q. Cæcilius Celer, another who distinguished himself by his spirited exertions against Cataline. He married the sister of Clodius, who disgraced him by her incontinence and lasciviousness. He died 57 years before Christ. He was greatly lamented by Cicero, who shed tears at the loss of one of his most faithful and valuable friends.—L. Cælius, a tribune in the civil wars of J. Cæsar and Pompey. He favoured the cause of Pompey, and opposed Cæsar when he entered Rome with a victorious army. He refused to open the gates of Saturn's temple, in which were deposited great treasures; upon which they were broke open by Cæsar, and Metellus retired when threatened with death.—Q. Cæcilius, a warlike general who conquered Crete and Macedonia, and was surnamed *Macedonicus*. He had four sons, of which three were consuls, and the other obtained a triumph, all during their father's lifetime.—A general of the Roman armies against the Sicilians and Carthaginians. Before he marched, he offered sacrifices to all the gods except Vesta; for which neglect the goddess was so incensed, that she demanded the blood of his daughter Metella. When Metella was going to be immolated, the goddess placed a heifer in her place, and carried her to a temple at Lanuvium, of which she became the priestess.—Another, surnamed *Dalmaticus* from his conquest over Dalmatia, A. U. C. 634.—Cimber, one of the conspirators against J. Cæsar. It was he who gave the signal to attack and murder the dictator in the senate-house.—Pius, a general in Spain, against Sertorius, on whose head he set a price of 100 talents and 20,000 acres of land.

METEMPSYCHOSIS, (formed of μετα "beyond," and εμψυχω "I animate or enliven"), in the ancient philosophy, the passage or transmigration of the soul of a man, after death, into the body of some other animal.

Pythagoras and his followers held, that after death mens souls passed into other bodies, of this or that kind, according to the manner of life they had led. If they had been vicious, they were imprisoned in the bodies of miserable beasts, there to do penance for several ages; at the expiration whereof, they returned afresh to animate men. But, if they lived virtuously, some happier brute, or even a human creature, was to be their lot.

What led Pythagoras into this opinion was the persuasion he had that the soul was not of a perishable nature: whence he concluded that it must remove into some other body upon its abandoning this. Lucan treats this doctrine as a kind of officious lie, contrived to mitigate the apprehension of death, by persuading men that they only changed their lodging and only ceased to live to begin a new life.

Reuchlin denies this doctrine; and maintains that the metempsychosis of Pythagoras implied nothing more than a similitude of manners, desires, and studies, formerly existing in some person deceased, and now revived in another alive. Thus when it was said that Euphorbus was revived in Pythagoras, no more was meant than that the martial virtue which had shone in Euphorbus at the time of the Trojan war, was now, in some measure, revived in Pythagoras, by reason of the great respect he bore the *athletæ*. For those people wondering how a philosopher should be so much taken with men of the sword, he palliated the matter, by saying, that the soul of Euphorbus, *i. e.* his genius, disposition, and inclinations, were revived in him. And this gave occasion to the report, that Euphorbus's soul, who perished in the Trojan war, had transmigrated into Pythagoras.

Ficinus asserts, that what Plato speaks of the migration of a human soul into a brute, is intended allegorically, and is to be understood only of the manners, affections, and habits, degenerated into a beastly nature by vice. Serranus, though he allows some force to this interpretation, yet inclines rather to understand the metempsychosis of a resurrection.

Pythagoras is said to have borrowed the notion of a metempsychosis from the Egyptians; others say, from the ancient Brachmans. It is still retained among the Banians and other idolaters of India and China; and makes the principal foundation of their religion. So extremely are they bigotted to it, that they not only forbear

Metemptosis.

forbear eating any thing that has life, but many of them even refuse to defend themselves from wild beasts. They burn no wood, lest some little animalcule should be in it; and are so very charitable, that they will redeem from the hands of strangers any animals that they find ready to be killed. See PYTHAGOREANS.

METEMPTOSIS (from μετα "post," and πιπτω *cado* "I fall,") a term in chronology, expressing the solar equation, necessary to prevent the new moon from happening a day too late. By which it stands contradistinguished from *proemptosis*, which signifies the lunar equation, necessary to prevent the new moon from happening a day too soon.

The new moons running a little backwards, that is, coming a day too soon at the end of 312 years and a half; by the proemptosis, a day is added every 300 years, and another every 2400 years: on the other hand, by the metemptosis, a bissextile is suppressed each 134 years; that is, three times in 400 years. These alterations are never made but at the end of each century; that period being very remarkable, and rendering the practice of the calender easy.

There are three rules for making this addition or suppression of the bissextile day, and, by consequence, for changing the index of the epacts. 1. When there is a metemptosis without a proemptosis, the next following, or lower index, must be taken. 2. When there is a proemptosis without a metemptosis, the next preceding or superior index is to be taken. 3. When there are both a metemptosis and a proemptosis, or when there is neither the one nor the other, the same index is preserved. Thus, in 1600, we had D: in 1700, by reason of the metemptosis, C was taken; in 1800, there will be both a proemptosis and a metemptosis; so the same index will be retained. In 1900, there will be a metemptosis again, when B will be taken; which will be preserved in 2000, because there will then be neither the one nor the other. This is as far as we need compute for it: But Clavius has calculated a cycle of 301800 years; at the end of which period, the same indices return in the same order. See EPACT.

Meteor; Meteorological.

METEOR, (by the Greeks called μετεωρα, q. d. *sublima* or "high raised;" by the Latins *impressiones*, as making signs or impressions in the air), commonly denotes any bodies in the air that are of a flux or transitory nature. Hence it is extended to the phenomena of hail, rain, snow, thunder, &c.; but is most commonly confined to those unusual and fiery appearances named *falling-stars*, *ignes fatui*, *auroræ boreales*, &c. whether they appear at a great distance from the earth or not. See METEOROLOGY.

METEOROLOGICAL, something belonging to meteors.

METEOROLOGICAL Journal, is a table recording the daily state of the air, exhibited by the barometer, thermometer, hygrometer, anemometer, and other meteorological instruments. We have many journals of this kind, kept at the house of the Royal Society, and by different observers in other places, in the Philosophical Transactions, the Memoirs of the Academy of Sciences, and similar publications.

METEOROLOGY;

THAT science which investigates the phenomena of our atmosphere* (commonly called *meteors*), giving an account of the circumstances attending each, and explaining the cause from whence they arise.

* See Atmosphere.

1 Meteors, how divided.

In considering this science, we find the objects of it naturally divided into two classes, *viz.* those which rise high in the heavens, seemingly without any connection with this earth; and others which are more particularly connected with the earth, or are perceptible only in the lower regions of the atmosphere. The former, which may properly be called *celestial meteors*, are only three in number, *viz.* the large fire-balls, falling stars, and aurora borealis. The second class is much more numerous; including the phenomena of the ordinary winds, rain, hail, snow, clouds and vapours of all kinds, thunder and lightning, hurricanes, whirlwinds, waterspouts, ignes fatui, and other wandering luminous appearances; not excepting the various changes of the atmosphere itself, with regard to its specific gravity, rarefaction, heat, and moisture, as indicated by the barometer, thermometer, and hygrometer.

2 Difficulties attending the subject.

To treat of all these in a satisfactory manner, it is plain that we ought to have an intimate acquaintance with the constitution of the atmosphere; with the nature of those powerful agents by which it appears to be principally influenced, *viz.* fire, light, and electric fluid; and with their peculiar modes of operation and action upon one another and upon the atmosphere, and this in every possible variety of circumstances. Nor is even all this sufficient: The various phenomena of rain, wind, snow, thunder, heat, cold, &c. are known to depend very much upon the situation of different places on the surface of the earth; and their occasional variations are with great reason *suspected* to proceed, partly at least, from changes which take place in the bowels of the earth *: whence a meteorologist ought not only to be perfectly well acquainted with geography, but with mineralogy also; and that to an extent at which human knowledge will probably never arrive.

* See Weather.

In a science so very difficult, it is not to be supposed that any thing like a certain and established theory can be laid down: our utmost knowledge in this respect goes no farther as yet than to the establishment of a few facts; and in reasoning even from these, we are involved every moment in questions which seem scarcely within the compass of human wisdom to resolve.

3 Causes probably concerned.

In considering the subject of meteorology, it will readily be admitted, that the whole atmospherical phenomena depend some how or other upon the action of the sun upon the earth, and the annual and diurnal revolutions of the latter. As these causes, however, are always invariably the same, why do we not find the same regularity in meteors that we do in other phenomena of nature? The eclipses of the sun and moon, for instance, which depend on the different positions

ſitions of the earth and moon with regard to the great luminary, are found to follow a certain and regular courſe; ſo that the very ſame eclipſes, both as to quantity and duration, which happened before will happen again. But with meteors the caſe is quite different. Moſt of the atmoſpherical phenomena are ſo various and uncertain, that no perſon can pretend to reduce them to any kind of rule. Every ſucceeding year, for inſtance, differs in a vaſt number of particulars from that which preceded it, even in ſuch as are the moſt ſimilar to one another. Sometimes we find a number of years ſucceſſively ſimilar to one another, and another ſet quite different taking place immediately after them; and ſome have even fancied that this ſucceſſion took place every 19 years, nearly the time of the revolution of the moon's nodes, though the obſervations on which this opinion is built are far from being ſufficient to eſtabliſh it; at any rate, the diſſimilarity between the phenomena of different years may ſufficiently warrant us to conclude, that other cauſes beſides the regular action of the ſun and revolution of the earth are concerned. Some of theſe cauſes may be ſuppoſed to be fermentations and other commotions within the bowels of the earth itſelf; but as all fermentation is a regular proceſs, and takes place only in certain circumſtances, of which heat is a very conſiderable one, why is there not annually a certain quantity of this fermentation excited, and why are not regular effects obſerved in proportion? It does not indeed appear, that the immenſe variety which occurs in meteorological appearances can by any means be accounted for but by the interference of ſome cauſes in their own nature *irregular;* that is, capable of ſuch endleſs variety, that no aſſignable ſpace of time is ſufficient to exhauſt it. Theſe cauſes as they cannot be proved to exiſt either on the ſurface of the earth or in its internal parts, muſt be ſought for in the celeſtial expanſe itſelf. Sir Iſaac Newton ſuppoſed the planets to be influenced by the comets, and that from the tails of the latter ſome of the finer parts of our atmoſphere were produced. He even ſuppoſed, that from theſe bodies a quantity of water, imagined to be waſted in the various operations of nature, might be ſupplied. But if it is not unreaſonable to ſuppoſe that *comets* anſwer ſome ſuch purpoſes in nature, it is as little unreaſonable to think that the *planets* may influence the atmoſpheres of one another. That this muſt be the caſe indeed is very probable, not only on account of the light they reflect upon one another, but alſo by reaſon of their ſpheres of mutual attraction, which extend an immenſe way, and are ſo powerful in the planets Jupiter and Saturn, that they diſturb the motions of each others ſatellites as they paſs. But beſides even theſe cauſes, if we allow them to be ſuch, there are others which take place in the immenſe void betwixt the celeſtial bodies, and which has with great impropriety been determined an abſolute vacuum. That changes do take place in this ſpace, is evident from what is related of the temporary diſappearance of ſome of the ſatellites of Saturn, and their ſudden re-appearance, without any perceptible change in our atmoſphere ſo as to affect our view of other celeſtial objects. It may appear ridiculous to think, that a change in ſuch diſtant regions ſhould have any influence upon the atmoſphere of the earth; but we muſt remember, that if the univerſe is connected together as one vaſt ſyſtem, which we have every reaſon to believe, it is as impoſſible that a change can take place in any part without affecting the whole in ſome degree, as it is impoſſible to change any part of a clock or watch without in ſome meaſure affecting the whole movement.

4 Some of them probably exiſt in the celeſtial expanſe;

But of all the changes which take place in the celeſtial regions, thoſe which affect the ſun ſeem moſt likely to produce changes in our atmoſphere, and to be the hidden cauſe of many meteorological phenomena. That the ſun is not exempt from thoſe changes, is evident from the ſpots which are always or for the moſt part to be ſeen on his diſk when viewed through a teleſcope. It has been obſerved in ſome years, that the ſun has ſeemed to loſe his influence, and even to the naked eye appeared much dimmer than uſual. In ſuch caſes it is impoſſible but our atmoſphere, and even the whole ſolar ſyſtem, muſt have been affected; and not only muſt the ſeaſons for the preſent time have felt the malign influence of thoſe ſpots, but the atmoſphere itſelf may have acquired ſuch a diſpoſition as to produce ſeaſons of a peculiar nature for a number of years afterwards. If it be true, according to the hypotheſis of ſome, that the ſun is ſupplied with fuel by comets falling into his body, it is plain that every new acceſſion of this kind muſt have a proportionable effect upon all the bodies expoſed to his light. If the comets do not perform any ſuch office, ſtill it is very probable that they anſwer ſome purpoſes to the planets, becauſe they are never ſeen without the planetary regions: and though their influence be not immediately perceptible, it is impoſſible to prove that they have none, nor indeed is it probable that they have not; for we are very certain, that the influence of any object extends as far as its light, and how much farther we cannot tell. Conſidering the matter in this view, therefore, there is not a ſpot which can obſcure the ſun, a comet that can appear in the celeſtial regions, a planet that can approach the earth, nor perhaps a belt or ſpot which can take place on Mars, Jupiter, or Saturn, which may not be productive of important changes in our atmoſphere, and affect the meteors produced by it in many different ways.

5 Or in the ſun.

It would no doubt be an error to have recourſe to ſo many obſcure cauſes, were there any plain and obvious ones from whence the phenomena could be deduced. But the endleſs variety of meteors which occur throughout every part of the globe, plainly ſhow that the cauſes, whatever they are, muſt be infinitely varied alſo. The principal one is no doubt the action of the ſun upon the earth and atmoſphere in its various poſitions: but this is regular; and, did nothing elſe interfere, would produce regular effects. Secondary cauſes probably are the action of the moon and planets: but theſe alſo are regular, though much more diverſified than the former: ſo that we are at laſt obliged to have recourſe to cauſes ſtill more obſcure and remote, as comets, ſpots on the ſun, and changes taking place in the etherial fluid which pervades the whole celeſtial expanſe. Theſe we muſt either aſſign as the remote cauſes of the phenomena of our atmoſphere,

6 Action of the ſun, moon, and planets, concerned.

ſphere, or admit others equally obſcure; or we muſt be contented to own our ignorance, as indeed muſt at all events be frequently the caſe.

But though, to ſatisfy ourſelves, ſuch conjectures may occaſionally be indulged, it is not from them that we are to derive any of the regular phenomena of nature; for theſe are evidently owing to the ſettled and eſtabliſhed action of heat, light, and electric matter, which have already been enumerated as the great powers influencing, and indeed in a great meaſure forming, the ſubſtance of our atmoſphere. The moſt remarkable effects of theſe are,

7 Evaporation a principal cauſe of meteors.

I. *Evaporation.* This, which is the principal cauſe of almoſt all the meteors of our atmoſphere, may be reckoned in a more particular manner the effect of heat. Upon this principle it is explained under the article CHEMISTRY, where vapour is ſhown to be a compound of water and fire; and ſuch it is ſuppoſed to be by M. de Luc, in his Treatiſe on Meteorology, as well as by other philoſophers of the higheſt rank. In conſidering this operation, however, as carried on by nature, we will ſoon find, that it proceeds in a manner very different from what takes place in our chemical operations. In the latter, evaporation is merely the effect of heat; and the proceſs cannot go on without a conſiderable degree of it, eſpecially if the veſſel containing the fluid be cloſe. In the natural way, on the contrary, the proceſs goes on under almoſt every degree of cold we know; the vapours aſcend to an height which has never yet been determined; and, from the extreme cold which they ſuſtain, ſhow evidently that they are connected with our atmoſphere by means of ſome other agent beſides heat. From the continual aſcent of vapour indeed, if the operations of nature were of the ſame kind with thoſe of art, the upper parts of our atmoſphere would be always involved in a fog, by reaſon of the condenſation of the vaſt quantity which continually aſcends thither: but ſo far is this from being the caſe, that in thoſe elevated regions to which the vapours continually aſcend, the air is much drier than at the ſurface of the ground. This was experienced by M. de Sauſſure and M. de Luc in their journeys up the Alps. The air was there found to be exceſſively dry, and evaporation to go on much more rapidly than below; ſo that the ſurface of their bodies was parched up, and an exceſſive thirſt took place by reaſon of the great abſorption of the moiſture. The ſame dryneſs was manifeſt by the hygrometer, which could ſcarce ever be brought to indicate any moiſture, even when our travellers were ſurrounded with clouds, hail, and rain. From many experiments, indeed, it is evident, that water, after being reduced into a ſtate of vapour, is capable of undergoing a certain change, by which it lays aſide its fluidity entirely, and even to appearance its ſpecific gravity; ſo that it becomes, as far as we can judge, a ſubſtance totally different from what it was before. This may be underſtood from the common operation of ſlacking lime; for in that caſe, the water unites with the lime ſo intimately, that the whole aſſumes the form of a dry powder, extremely greedy of moiſture, and which cannot be reduced to its former ſtate of quicklime without undergoing a much greater degree of heat than the water by itſelf could bear. The ſame thing is manifeſt from mixing dry plaſter of Paris with water; for thus a vaſt quantity of the water is fixed, and becomes in a manner ſolid. A ſtill more remarkable inſtance is in ſending the ſteam of water over red-hot iron; for there the fluid unites in ſuch a manner with the metal, that it cannot be expelled from it even by the heat of a burning-glaſs. Other inſtances are mentioned under the article WATER: here we are to conſider the changes which the element undergoes after being reduced to the ſtate of vapour. The firſt of theſe is, its aſſuming the appearance of ſmoke or fog when mixed with the common atmoſphere; which ſmoke, when examined by a microſcope, appears to be compoſed of an infinite number of ſpherules of water, hollow, and filled with a fluid ſpecifically lighter than air, by which means they aſcend in it. As long as the aqueous vapour retains this viſible form, it retains alſo its humidity, and will again become a liquid, and wet whatever comes in its way; and this the more readily, while it retains any ſenſible degree of heat. As the vapour cools in the atmoſphere, it gradually aſſumes an aerial ſtate, mixing itſelf with the air ſo as to be no longer diſtinguiſhable from it. In this ſtate the air itſelf does not by any means appear to become more moiſt, but continually drier the more water it receives. This, however paradoxical it may ſeem, is a certain fact: for in ſummer, though we are aſſured that evaporation goes on very rapidly from the ſurface both of the ſea and land, yet the air, ſo far from being moiſt, is much drier than at any other time; and yet we know that the whole quantity evaporated is ſome how or other received by the atmoſphere. After the water has attained to this ſtate, our inquiries concerning it muſt in a great meaſure ſtop. We know not now, whether it has the form of ſmall hollow ſpherules, or whether it really becomes part of the atmoſphere itſelf, and aſſumes the form of what we call *dephlogiſticated air*. From ſome experiments in which that kind of air is produced from water, we are certain, that part of this element is converted into air: but in theſe operations, the evaporation of the water is prevented by being carried on in cloſe veſſels; ſo that we cannot tell whether that which would be mere ſteam in the open air, becomes dephlogiſticated air in cloſe veſſels or not. From the immenſe waſte of dephlogiſticated air, indeed, and the vaſt quantity which always ſurrounds the earth, we may ſuſpect that the water, after undergoing the natural proceſs of evaporation, does really become changed into this aerial fluid; and thus we will have a more ample ſource of it than can be derived from vegetation, or any other cauſe with which we are yet acquainted.

8 Natural evaporation different from artificial.

9 Dryneſs of the upper regions of the atmoſphere.

10 Surprising inſtances of this dryneſs.

11 Water ſometimes changes its nature.

12 Particular account of natural evaporation.

13 Is capable of being decompoſed.

14 Obſervations of M. de Luc.

On this ſubject M. de Luc has ſome very curious obſervations, built principally upon the new doctrine of the compoſition of water; which, though a poſition maintained by the antiphlogiſtians, is by no means inconſiſtent with the exiſtence of phlogiſton, but rather a proof of it. Our author firſt began to alter his ſentiments concerning the *aqueous* exiſtence of vapour in the atmoſphere, from the circumſtance already mentioned concerning the great *dryneſs* of the upper atmoſpherical regions already taken notice of.

A

A very remarkable instance of this was, that the ferule of his cane dropped off during his journey up one of the Alpine mountains, which he never had observed it to do before. It is observed likewise, that the air in these elevated regions is somewhat drier in the night than in the day-time; for which M. de Luc gives the following reason, viz. that the air on the plains being condensed by the cold, the superior air must subside, and the air on the mountains of course be replaced by the drier air from above them; though he thinks that this dryness may also be imputed in part to some other cause. This increase of dryness in the night, however, seems less constant than that in the day-time. Our author has often arrived at the tops of mountains before sun-rise, and sometimes found the grass covered with dew; though he never had the good fortune to be able to determine the state of the air for want of an hygrometer: nor indeed could the appearance of dew be any certain indication of the state of the atmosphere, there being strong reasons to believe, that dew is occasioned in great measure by vegetables themselves; for grass, when covered with glass plates, was found to become moist as well as that which had been exposed to the open air. In this case, the plates became moist both on the upper and under sides; but when suspended a foot above the ground, they were found to be covered with dew only on the upper part.

15 M. Saussure's method of accounting for the dryness of the air.

The dryness of the air on the tops of high mountains was otherwise accounted for by M. Saussure.—When on Mount Blanc, at the height of 7200 feet above the level of the sea, he found, that from six in the evening till half past five the next morning, his hygrometer moved 21 degrees (the whole scale containing 100) towards dryness. But this he accounts for by saying, that from sunrise to three or four in the afternoon, the quantity of vapours in the neighbourhood of the earth is continually diminishing, because they *ascend* in the atmosphere, either in virtue of their own levity, or by means of a vertical wind, which he supposes to be produced by the heat of the sun; that, from the time just mentioned till next morning, their quantity increases in the lower strata, because the upper vapours re-descend in proportion as they condense; and that in the higher regions of the atmosphere, the reverse ought to be the case, as the upper strata are then left drier by the previous descent of the vapours. This argument, however, is contradicted by M. Saussure himself in another part of his work; where he says, that in the middle of the day, when the sun is hottest, the air in the neighbourhood of the earth contains really more *water* than it does at the moment when a refreshing dew falls. It is besides impossible that a *vertical* wind can ever be occasioned by the heat of the sun; for this produces only a general expansion of the whole body of the atmosphere, as a condensation of it is occasioned by the action of cold: neither could any considerable quantity of vapour (supposing with M. Saussure that it is a chemical solution of water in air) descend in the night-time; for, according to him, this compound differs very little from common air in its capacity of being expanded and condensed. Neither, according to M. Saussure himself, can any part of the water with which the air is combined descend at all, until some portion of the former becomes supersaturated with it, that is, till it has received more than it can hold in solution. But if this should happen to be the case, the superfluous quantity would then appear in the form of a mist or cloud, and the hygrometer would indicate extreme humidity; whereas the contrary indication constitutes the difficulty.

16 Insufficient

17 Aerial vapour cannot be condensed by cold.

It is besides evident, from innumerable instances, that mere cold will not by any means occasion the condensation of aerial vapour. A most remarkable example of this is given by M. de Luc, in an account of a storm in which he was involved on one of the Alps. "Though the hygrometer (says he) was within $33\frac{1}{3}$ degrees of extreme dryness, or $66\frac{1}{3}$ from extreme humidity, thick clouds formed around us, which obliged us to think of retreating: in a little time the summit of the mountain was surrounded by them: they spread and covered the whole horizon: a premature night surprised us in a very dangerous road; and we suffered one of the most violent tempests I ever experienced, of wind, rain, hail, and thunder. The storm lasted great part of the night, and extended all over the neighbouring mountains and plains; and after it had ceased, the rain continued, with only a few intermissions, till next day at noon. In one of these intervals, I examined the hygrometer on the outside of our cabin; it showed only $1^{\circ}\frac{6}{10}$ more humidity than before; and even this increase was no more than what the difference of heat was capable of producing. Nevertheless, new clouds continually rolled around us; and the rain, which presently began again, accompanied us as it were by fits to the bottom of the mountain. When arrived there, we saw the clouds disperse entirely. I observed the hygrometer again in the open air; and though the earth was all drenched with water, and the heat of the sun much less, the hygrometer was $1^{\circ}\frac{7}{10}$ drier than it had been two days before, after a course of fine weather. Where was all this water, and all the ingredients of the storm, while the hygrometer showed such a degree of dryness in the very stratum where it was formed?"

18 M. de Luc's definition of vapour.

M. de Luc adopts the opinion concerning vapour which has been published in this work, under the articles CHEMISTRY, EVAPORATION, and many others, viz. that it is a combination of fire with water. By *vapour*, however, he does not mean the visible steam issuing from heated liquids, but that invisible and subtile fluid which is found to be formed even *in vacuo*, and which of consequence disproves the hypothesis of those who hold that vapour is a solution of water in air. Our author, however, gives a solution of the difference betwixt what he calls *fog* or *mist* and vapour, which seems not founded upon any evident principle. According to him, this vapour cannot subsist unless the particles of water united to the fire be at a certain distance from one another. When this distance is lessened, a decomposition takes place by reason of the attraction of the aqueous particles to one another: and they then appear in their proper form of a liquid, the fire dissipating itself through the atmosphere. The smallest distance to which the particles can be brought without any decomposition, varies

varies according to the temperature; but is always constant in the same degree. When the thermometer stands at temperate, or thereabouts, watery vapours, compressed into the smallest space they can bear, are found to have between $\frac{1}{10}$th and $\frac{1}{30}$th of the elasticity of air; but have less than $\frac{1}{120}$th of its weight. If such vapour, however, be mixed with air, the minimum distance is greatly increased, by reason of the interposition of aerial particles; and thus it can subsist under a much greater pressure than it could otherwise endure. In the heat of boiling water they can, without any mixture of air, bear the pressure of the atmosphere: for ebullition, under any given pressure, cannot take place until the vapour produced in the liquor has acquired a degree of expansive force sufficient to raise the liquor into bubbles under that pressure; and as long as the vapour retains this heat, it must continue capable of resisting the same pressure. As the heat abates, a decomposition begins; hence the opaque steam over boiling water, which, by becoming vapour again by uniting with the fire it meets with in a large space, is diffused by its expansibility.

19 Evaporation of the clouds.

Thus, vapours are continually undergoing decompositions and new vaporifications. This evaporation of the clouds after they were once formed, M. de Luc observed very evidently; some parts being continually detached, and gradually diminishing and disappearing while new ones are formed; so that the clouds do not continue the same for two moments together; and the evaporation goes on so fast, that a cloud could not subsist without constant and large supplies.—These phenomena appear to be independent of heat and cold; for sometimes clouds form suddenly in the middle of a hot day; and after they have poured down their water, all is clear again: and sometimes they evaporate after sunset, gradually vanishing in the calmest weather without any change of place.—The appearances are such as would be produced by a large mass of water in violent ebullition, suspended invisibly in the atmosphere; and the similarity of effect naturally points out an analogy in the cause; that is, a source of vapour in the atmosphere itself. It is only when the vapour is produced too abundantly and too rapidly to be dispersed by evaporation that rain is formed; the vesicles in this case running together, and the water falling to the lower part, as it does in soap-bubbles, till they become thin enough to burst.

20 Remarks on M. De Luc's observations.

With regard to this explanation, however, though it may account for the artificial production and decomposition of vapour, it does not seem to answer for that produced in the natural way. That the latter is certainly in a state of dryness, cannot be denied; but it cannot be proved that ever any artificial steam is so, let the heat be what it will. Though the approach of the aqueous particles to one another, therefore, by a diminution of temperature, may occasion the decomposition of artificial steam, it does not seem to be so in the natural way; nor is there any source from which we can reasonably infer a very great and sudden accession of vapour from the earth to the upper regions of the atmosphere in particular places, which might increase the proximity of the aqueous particles, and thus bring on rain according to M. de Luc's hypothesis. It must likewise be remembered, that, according to the doctrine upon which M. de Luc founds his system, water, when decomposed, is not converted into one species of air, but into two, viz. the dephlogisticated and inflammable, each of which contains a quantity of undecomposed water; so that there is still some ambiguity in the experiments; and as the two shrink up into very little bulk by their union, there should seem to be danger of producing vacuums of immense extent by the sudden union of the two airs in the high atmospherical regions.—These vacuums, were they to extend over the whole space occupied by a large cloud, might occasion dreadful concussions by the rushing in of the air to supply them: or even if we suppose them to be dispersed interstitially, they must certainly affect the barometer very greatly: which does not appear to be the case. M. Saussure, who passed several nights on one of the Alps, at the height of 10,578 feet above the level of the sea, does not mention any considerable variation of the barometer, though he was frequently involved, during that time, in the most violent storms of hail, wind, snow, thunder, and lightning. In the warm climates also, where we should think that the vast deluges of rain would often sink the barometer to an amazing degree, yet we seldom hear of any remarkable variation. M. de Prielong, in his account of Meteorological Observations made at Goree in 1787, informs us, that there were 16 or 18 hurricanes; and that the greater part of these raised the barometer from one-twelfth to a sixth part of an inch; others sunk it as much, and some did not at all affect it. Another cause must therefore be concerned, which diminishes the rarefaction, or condenses the air as fast, or nearly so, as the condensation of the vapour would rarefy it: and that another cause really is concerned, we learn from M. Reynier, who has made a great number of observations upon the vapours formed on the Alps, and gives us the following account. "In the morning, the vapours condensed by the coldness of the night rise along the mountains in proportion as the sun rises above the horizon.—When the weather will be fine, they glide uniformly on the brink of the mountain, and rise over it by a regular motion, somewhat slow. When rain impends, the motion is irregular: they are alternately attracted and repelled by the mountain, and rise like elastic bodies rebounding. In a stormy season, particularly when there will be hail, the motions are still more rapid and irregular." "This observation (add the Monthly Reviewers, from whom the above quotation was taken) may be confirmed in the mountainous countries of Great Britain; we have seen it among the mountains of Cumberland, particularly in the neighbourhood of Keswick. M. Reynier observes, and the observation is sufficiently near the surface not to be overlooked, that the appearance is electrical."

21 M. Reynier's observations.

22 Considerations on the nature of the fluid into which water is reduced by evaporation.

Before we proceed to give any solution of the *decomposition* of vapour, it will be necessary to consider a little farther the nature of the fluid or fluids into which water is converted when it assumes a dry state in the atmosphere. In the experiments of Lavoisier and others, it seems with great probability to be reduced into the two different kinds of air already mentioned; but M. de Luc does not think that the atmosphere

mosphere naturally contains any such fluids. Air, when artificially decomposed, does not contain inflammable, but phlogisticated or mephitic, air, mixed in a certain proportion with the dephlogisticated kind. These have different specific gravities; and our author is of opinion, that two fluids of this kind could not mingle uniformly with one another without separating through time; and as the dephlogisticated air has the greatest specific gravity, it thence follows, that the under parts of the atmosphere ought to be almost entirely composed of that kind, and the upper strata of the mephitic or inflammable kind. But this does not appear to be the case; so that M. de Luc concludes, that air is an homogeneous fluid, every particle being similar to every other, and consisting of all the ingredients that we extract from the mass, together, probably, with others yet unknown to us. Though a mixture of vital and mephitic air produces many of the effects of atmospheric air, we cannot thence conclude their absolute identity: the one may suffer a decomposition in order to the production of these effects, while the other produces them immediately. The mixture may support life for a time, but will it equally maintain health also? Though mephitic air by the mixture of one-third of vital air is prevented from being immediately fatal, we are not authorised to conclude that it is altogether innocent. On the whole then, if it is not in the immediate product of evaporation that rain has its source; if the vapours change their nature in the atmosphere, so as to be no longer sensible to the hygrometer or to the eye; if they do not become vapour again till clouds appear; and if, when the clouds are formed, no alteration is observed in the quality of the air; we must acknowledge it to be very probable, that the intermediate state of vapour is no other than air; and that the clouds do not proceed from any distinct fluid in the atmosphere, but from a decomposition of a part of the air itself, perfectly similar to the rest."

This opinion of M. de Luc appears the more probable, that the two ingredients into which water is artificially resolved, by the late experiments do not by any means re-compose atmospherical air by simple mixture; for these explode with extreme violence on the application of flame: the common atmosphere, also, when decomposed, does not resolve itself into dephlogisticated and inflammable air, but into the former, and what is called phlogisticated or the mephitic kind, the difference of which in specific gravity is much less than between dephlogisticated and inflammable airs, though it is probable that even these are connected either by means of a chemical union, or by some other ingredient we do not yet know. By this union the qualities of both may be in some measure changed, and a third kind of substance formed, as neutral salts may be made out of acids and alkalies. This third substance, which we call the common atmosphere, is proper for preserving both animal and vegetable life, which neither of the two ingredients are capable of doing; for plants wither and die in dephlogisticated air, and animals are suffocated in a moment by the mephitic kind; nor, indeed, do we know whether the dephlogisticated kind be altogether proper for the sustenance of animal life for any considerable length of time. It certainly will sustain it much longer than an equal quantity of atmospherical air, even the purest we are acquainted with; but it is equally certain that animals confined in it die much sooner than according to its apparent purity they ought to do. It is not an unreasonable hypothesis, therefore, that though water may be artificially separated into the two fluids called dephlogisticated and inflammable airs, yet in the natural way the decomposition does not proceed beyond a certain point, which we may, in a subject of such an obscure nature, call a *chemical union*, or a state in which the two ingredients exist, and are capable of being separated when the air comes into contact with certain substances. Hence, when the atmosphere is taken into the lungs of an animal, some of the dephlogisticated part may enter the blood, and the phlogisticated part combining more intimately with the rest, may form fixed air or part of it appear in its proper form. In like manner, when the common atmosphere comes in contact with a vegetable, it is possible that the phlogisticated part may be absorbed by it, and the dephlogisticated part set free, which in the atmosphere may form new combinations, &c.

23 Air and water convertible into each other.

Granting this to be the case, and we can scarcely hope for a more probable conjecture on the subject, the decomposition of the vapour will be easily accounted for. If by any natural process the water can be converted into air, and if the latter is only water partially decomposed; then, by an inversion of the process, air may be instantly re-converted into water, and will become visible in fog or mist, or be condensed into rain, consisting of greater or smaller drops, according to the degree to which this inverted process is carried. With regard to the means used by nature for carrying on these two opposite processes, we can say very little; because the agents concerned in them are entirely beyond the reach of our senses. From M. Reynier's observation, indeed, of the clouds being attracted by the hills, it would seem probable that electricity was ultimately concerned, but in what manner we cannot determine. On this hypothesis, however, we may explain the phenomenon taken notice of by M. de Luc and others, viz. that even during the time of excessive rains the hygrometer showed scarce any signs of moisture, and that the clouds were in a constant state of evaporation or dissolution in the air. The hygrometer, we know, cannot show signs of moisture, unless it absorbs it; and it cannot absorb, unless the air around it really contains more vapour in an aqueous form than the hygrometer itself does. But in very elevated regions this can scarce ever be the case. So much of the pressure of the atmosphere is then taken off, that the water contained in any substance resolves itself into vapour with the utmost facility. Hence bodies brought from the lower regions into the higher will undoubtedly part with a great deal of the moisture they contained in the lower parts of the atmosphere, and which was kept in it by the superior pressure of the atmosphere in these parts. For the same reason, though the air in the upper regions should be made ever so moist, a body such as the hygrometer can never absorb so much as it would otherwise do, because the water in these regions has a natural tendency to fly away from it. It appears, however, that there was in reality *some* variation of the hygrometer, though small; and had it been possible to con-

ſtruct an hygrometer of materials found on the top of the mountain, which might be ſaid to be naturalized to the climate, the ſcale of variation might probably have been larger, though there is no reaſon to think that it ever would be ſo large as on the plain. For the ſame reaſon, as ſoon as the proceſs has been inverted, by which water was converted into air, the evaporation inſtantly takes place in the vapour that has been produced. We are to conſider, that the atmoſphere is never diſpoſed to let fall *the whole* of the vapour it contains, for this would amount almoſt to an annihilation of it. Both proceſſes go on at once; and it is only in particular parts that the reverſe proceſs takes place. Thus clouds are formed: but as theſe ſeldom continue ſtationary, they no ſooner come into a ſituation where the contrary operation is going on, than they begin to evaporate; and even in the very ſame place, as ſoon as the condenſing proceſs has ſtopped, the other begins; as we ſee that even in the moſt damp and moiſt weather there is a conſtant evaporation going on; ſo that during the very time that rain is falling, the atmoſphere is taking up what lies upon the ground.—Hence alſo we may ſee why the hygrometer indicated a greater degree of dryneſs in the night than in the day time, viz. becauſe the evaporation from the earth is leſs during the night than in the day time.

24 Electricity of the atmoſphere conſidered.

II. Having now in ſome meaſure explained the phenomena of natural evaporation, we muſt next conſider thoſe of the *Electricity* of the atmoſphere. Under the article ELECTRICITY, the nature of that fluid is ſo fully diſcuſſed, and its identity with the ſolar light rendered ſo probable, that there ſeems no farther occaſion for entering into ſpeculations upon the ſubject. We ſhall therefore, without taking any notice of the arguments of M. de Luc for its being a compound fluid, proceed to conſider, according to the principles laid down in that article, how far electricity is concerned in producing the phenomena of meteorology.

25 Different agents concerned in producing all meteors.

In this inquiry we muſt obſerve, that as none of the agents by which thoſe phenomena are produced can act by themſelves, but muſt always be aſſiſted by the reſt, ſo we are not to aſcribe any one phenomenon to the influence of a ſingle agent without the reſt.—Thus, though in evaporation heat is principally concerned, and though evaporation is the principal cauſe of the appearance of clouds, &c. yet we do not find that heat is the *ſole* cauſe of evaporation; neither is evaporation the ſole cauſe of the appearance of clouds. In like manner, though electricity is the principal cauſe of many of the more grand phenomena of nature, yet electricity does not act by itſelf, but in conjunction with aqueous vapours; and when the atmoſphere ceaſes to contain any of theſe vapours, it is highly probable that it ceaſes to manifeſt any of the common effects of electricity alſo.

26 Electricity of the earth explained.

The general electricity of the earth has, under the article ELECTRICITY, been ſhown to depend upon the abſorption of the rays of the ſun by the land and water, eſpecially by the latter. As this abſorption muſt undoubtedly be ſtrongeſt in thoſe places where the greateſt quantity of rays fall upon the ſurface, it follows, that the emiſſion muſt be greateſt where the feweſt are abſorbed; that is, at the poles. Hence, were there no obſtacles, the electrical fluid would iſſue forth in vaſt quantities at each pole, very little being emitted in the intermediate ſpaces. By reaſon of the reſiſtance made by the great body of the earth, and the immenſe fields of ſnow and ice with which the polar regions are conſtantly enveloped, and which are much leſs perfect conductors than liquid water, the electric fluid, once abſorbed, has no free paſſage through any particular part of the globe, and therefore forces out every where throughout the whole ſurface. This paſſage is facilitated by the moiſture contained in the atmoſphere; and thus the proceſſes of evaporation and electricity aſſiſt one another: for where the air has for a long time been very dry, we find that the electric fluid cannot readily paſs, and violent thunder and lightening, nay ſometimes earthquakes, are ready to enſue. Hence alſo the common obſervation relative to thunder, viz. that there is ſeldom much thunder when it begins to rain before the thunder comes on: The reaſon is, that the rain, being an excellent conductor, facilitates the paſſage of the electric matter through the air, and keeps up the equilibrium without any violence or exploſion.

As the electric matter gets out of the earth, it is naturally driven upwards to the higher parts of the atmoſphere, where it probably aſſiſts in the decompoſition of air, or reſolving air into water, as has been already ſaid. When clouds are formed, it preſſes ſtrongly upon them by reaſon of their conducting nature: and hence all clouds, whether high or low, are found to be electrified; as are likewiſe all fogs, of whatever kind. The fluid getting ſtill higher and higher, at laſt aſcends beyond the regions of our atmoſphere, into the unknown ſpaces which are the reſidence of thoſe firſt of all created agents which conduct the planets round the ſun, and act as the *primum mobile* of nature.

Thus there is a circulation in the electric fluid as there is in the water. It deſcends originally from the ſun; pervades the whole ſubſtance of the globe; and perſpiring, as it were, at every pore, aſcends beyond the clouds; and, paſſing the extreme boundaries of our atmoſphere, returns to the ſun from whence it came. As the ſphere of its action in returning, however, muſt always increaſe, it follows, that after it has got beyond the bounds of the atmoſphere, the ſigns of its action muſt continually become leſs and leſs, nay, moſt probably vaniſh entirely; becauſe it is there oppoſed by an immenſe quantity of ſimilar matter, acting in an oppoſite or different direction from itſelf.

27 How the electric matter is confined in the atmoſphere.

This laſt conſideration leads into a very curious ſpeculation, and in a very plauſible manner anſwers an objection, the force of which it would otherwiſe be very difficult to avoid. "If the electric fluid be no other than the light of the ſun abſorbed by the earth, and emitted from it again by innumerable ſmall vents, how comes it to paſs that it is not perpetually drained off from the upper regions as faſt as it arrives without ſhowing any ſign of being reſiſted. The phenomena of thunder, of rain, nay of every meteor, manifeſtly ſhow that it often meets with very great reſiſtance; but this could not happen, unleſs there was without the atmoſphere ſomething capable of reſiſting and counteracting the vehement impulſe of all the electric fluid with which the earth is filled. This reſiſtance is very evident: for if there were none, there could

could not be any accumulation of electricity in the upper regions of the atmosphere, but a rarefaction in it would take place similar to what there is of air in the same regions. But this is so far from being the case, that all the electrical phenomena are much stronger in the upper than in the lower regions."

28 Mr Morgan's solution controverted.

To solve this objection, Mr Morgan, in a late paper in the Philosophical Transactions, supposes that an absolute vacuum, such as he imagines the celestial spaces to be, is absolutely *impenetrable* by the electric fluid. But this seems not far from a contradiction. Sir Isaac Newton imagined the celestial spaces to be void of all matter, on account of the apparent facility with which the planets move through them; and we see that the rays of light, the impulse of which is accounted scarce any thing at all, do penetrate them. To suppose, indeed, that a mere non-entity can act either by resistance or any way else, is an absurdity. How can any person imagine, that a perfect vacuum, which even a feather by its weight can cause it pervade from one end to the other, should be impenetrable by a flash of lightning? It is true, indeed, that from some experiments it is found, that when the air is exhausted very perfectly from a receiver, we cannot force an electric spark through it. But this, so far from proving that there is *nothing* in the glass, plainly shows that there is *something* in it which makes a greater resistance than we can overcome: and it is very probable that this something is no more than the electric fluid itself; for as we are very certain that the electric fluid can *impel*, so we are equally certain that it can *resist*. The truth is, that it is not in our power to move this fluid at all but by lessening in one part the resistance it meets with; in which case it moves very freely of itself: just as we can move the air with great facility, provided we allow the rest to follow; but if we attempt to push a quantity of air before us, without allowing any to follow it to supply the vacuity, we will meet with a most violent resistance. In the case of electric fluid, we can make it circulate from one part of the earth to another by means of conductors: but we cannot force any part of it to a distance from the rest, nor can we cause a small quantity expel a large one from any place, otherwise than by breaking the equilibrium; in which case the quantity which follows is precisely equal to that which went before. In the case of a perfect Torricellian vacuum, we cannot discharge a bottle through it, without setting in motion all that quantity which is contained in the glass, as well as all that is connected with it, which it seems is more than the power of any machine can do. In like manner, the atmosphere of the earth being surrounded by an immense and inconceivable quantity of electric matter, it cannot escape without putting in motion a quantity of that matter equal to what goes out. But this quantity, upon the whole, can never be greater than that which the earth every moment absorbs from the sun. Were a greater quantity to issue forth, it would be resisted by all the rest, even to the utmost boundaries of the universe; a power which no created being could overcome. As matters stand at present, the resistance is inconceivably great: for from the laws of mechanics it is evident, that action cannot exist without re-action; so that where there is no resistance, there can be no effort. In all cases we see that where the electric matter has a good conductor, it moves silently, and without showing any marks of power whatever. If it meets with a small resistance it makes a small effort, and a greater one if a greater resistance is made, and so in proportion. The violence with which this fluid acts in some cases, shows the strength of the resistance to it all around: for, like other fluids, we are certain that this one also acts with equal force all around it, and the explosion is always made at the least resisting part. The electric fluid of the atmosphere, therefore, is confined by a very great power, which it is not by any means able to overcome, but which yields in a certain degree to its impulse every moment, in proportion to the fresh supplies yielded by it to the earth, and which supplies come every moment from the sun.

29 Of heat and cold as agents.

III. Heat and cold are very powerful agents in producing various meteors: but these are only relatives, and different modifications of the same fluid; the former being its action from a centre, the latter its action from a circumference to a centre. Though we do not know what connection there is between heat, cold, and what we call electricity, yet we know that this last is very much affected by them; for heat makes bodies more pervious to electricity than otherwise they would be, and cold makes them less so.—Hence the most violent electrical phenomena are observed in hot countries; while in the colder regions those which depend on a more moderate electrification, as auroræ boreales, are more frequent. The prevalence of heat and cold in particular places, however, depends upon circumstances which are altogether unknown to us; and therefore we cannot investigate the modes of their operation in such a particular manner as could be wished. From what has been already said, however, about the nature of the different agents concerned in meteorology, both in this article and in other parts of the work, we may take the following view of the causes of meteors in general.

30 Particular explanation of meteors.

1. Evaporation, combined with electricity, produces all the phenomena of vapour, fog, clouds, rain, &c.; and according as these two are joined to certain degrees of heat or cold, they produce dew, hoar-frost, rain, hail, or snow.

The phenomena of dew and hoar-frost seem to proceed from a quantity of aqueous and undecomposed vapour which always exists in the atmosphere; and which, being raised by mere heat, is condensed by mere cold, without undergoing that process by which water is changed into air. Hence it both ascends and descends; for if we cover a small space of ground with plates of glass, they will be wetted both above and below. The reason of this is, that the evaporation from the ground does not stop immediately after the air begins to cool, especially if it be covered with any thing which prevents the access of the cold air, as the glass plates do in this case. The cold air, therefore, acting upon the glass, condenses the vapour below it, in the same manner that the head of a still or the receiver of a retort condenses the vapours which rise from the matter to be distilled. If the cold be very intense, hoar-frost appears instead of dew; which is nothing more than the dew frozen after it falls upon the ground, in the same manner that the vapour in a

warm

warm room congeals on the inside of the windows in a frosty night. As this seems to be the whole process, it has not been observed that any electricity is concerned in the production of dew.

When the vapour has been thoroughly decomposed and become invisible, it very frequently returns back to its pristine state, so far as to assume the appearance of mist or fog. In this case, electricity appears evidently to be concerned; for Mr Cavallo has observed that all fogs are electrified. When the process has advanced farther, and the water begins to collect into drops, the electricity is still more remarkable; and it is with great reason supposed that it is by means of electrical repulsion that the drops of rain keep at a regular distance from one another. When the cold is intense and the electricity strong, the drops of water are frozen, and hail is produced: but snow indicates a more moderate degree of electricity; and a very violent cold, accompanied with a strongly electrical atmosphere, produces that excessively disagreeable vapour in the polar regions called *frost-smoke*, which is a general congelation of all the aqueous moisture contained in the atmosphere.

2. By violent electricity alone are produced the phenomena of thunder, lightning, fire-balls, ignes fatui, and the aurora borealis. In the phenomena of thunder, evaporation and the other agents by which rain and hail are produced are also concerned; though electricity is most remarkably so, and thunder and lightning of the most violent kind frequently occur without any rain. The ignis fatuus, aurora borealis, large fire-balls, and the smaller ones called falling-stars, seem to depend upon electricity alone, without any aid from evaporation, or from heat or cold. Aurora borealis, indeed, is most common in the northern and southern parts of the world, where the cold is intense; though this seems to be owing, not to the cold, but to the natural emission of the electrical fluid from the polar regions in much greater quantities than from others. The fire-balls commonly appear collected on the very extreme boundaries of the atmosphere, where, from the violent resistance already mentioned, the fluid is confined as it were in a concave shell, which it cannot by any means penetrate in great quantities in any particular place. Though these fire-balls, therefore, contain an immense quantity of this fluid, they can only proceed in an horizontal direction, and never fly perpendicularly up from the earth, as those will sometimes do which are formed nearer the ground. The ignis fatuus seems to depend on the strong electricity of a certain portion of atmosphere, the cause of which is not well understood.

3. By the action of heat and electricity combined, are produced the phenomena of hurricanes, whirlwinds, and water-spouts. It is not, indeed, known in what manner those agents combine themselves to produce such tremendous effects; but it seems evident that electricity is concerned in them, as the sea-water becomes unusually clear before an hurricane, and many signs of electricity are likewise observed in the heavens.

4. The winds are supposed to proceed mostly from the heat of the sun rarifying the atmosphere, and occasioning a continual influx of fresh air to fill up the vacuum; but very violent winds are frequently observed where no such cause can be supposed to exist.—Thus, on the tops of high mountains the winds are commonly very violent; and mountainous countries, especially when cold, are for the most part also subject to high winds. As the tops of mountains, however, are known to be strongly electrified by their attracting and repelling the clouds, we must suppose that this electricity has a considerable share in producing the winds which are generally so violent on their tops.—This will appear the more probable, when we consider that frequently storms of wind, and those of the most violent kind, seem to be brought along with clouds; as, for instance, that mentioned under the article MALTA, in which a dreadful tempest, brought along with a cloud, almost destroyed the whole town.

31 Uses of meteors.

Thus we have endeavoured to give a general sketch of the doctrine of METEOROLOGY: a more particular detail of the causes by which meteors are produced is given under the names of each of them as they occur in the order of the alphabet. With regard to their uses, those of the more magnificent and tremendous kind seem to be destined to preserve the balance of the electric fluid in the atmosphere, the want of which would be productive of the most fatal effects to the world in general. The effects of the inferior ones are more confined, and are of use only to particular districts, scarcely ever extending their influence over a whole country. Thus the clouds, which produce rain for the purposes of vegetation, do not extend themselves over a whole country at once, but transitorily fly over different parts of it; so that when it is rain, for instance, in one place, it may be sunshine in another, thunder in a third, &c. It is, however, surprising to observe how equally these act over the whole of a very large tract of land; so that though there is never precisely the same weather in two places twenty miles distant from one another, yet vegetation goes on without any perceptible difference in the one as well as the other; neither, unless there be some very remarkable difference in the weather of one year from that of another, will there be any perceptible difference in the crop. For a more particular investigation of this point, however, see the articles VEGETATION and WEATHER.

For the application of meteorology to the fore-knowledge of the weather, see the article WEATHER.

MET

Meteoromancy.

METEOROMANCY, a species of divination by meteors, principally by lightning and thunder. This method of divination passed from the Tuscans to the Romans, with whom, as Seneca informs us, it was held in high esteem.

MET

Metessib, Metheglin.

METESSIB, an officer of the eastern nations, who has the care and oversight of all the public weights and measures, and sees that things are made justly according to them.

METHEGLIN, a species of mead; one of the most

Method, Methodists

most pleasant and general drinks the northern parts of Europe afford, and much used among the ancient inhabitants: (See MEAD). The word is Welsh, *meddyglin*, where it signifies the same.—There are divers ways of making it; one of the best whereof follows: Put as much new honey, naturally running from the comb, into spring-water, as that when the honey is thoroughly dissolved an egg will not sink to the bottom, but be just suspended in it; boil this liquor for an hour or more, till such time as the egg swim above the liquor about the breadth of a groat; when very cool, next morning it may be barrelled up; adding to each 15 gallons one ounce of ginger, as much of mace and cloves, and half as much cinnamon, all grossly pounded; a spoonful of yeast may be also added at the bung-hole to promote the fermentation. When it has done working, it may be closely stopped up; and after it has stood a month, it should be drawn off into bottles.

METHOD, the arrangement of our ideas in such a regular order, that their mutual connection and dependence may be readily comprehended. See LOGIC, Part IV.

METHODISTS, in ecclesiastical history, is a denomination applied to different sects, both Papists and Protestants.

I. The *Popish Methodists* were those polemical doctors, of whom the most eminent arose in France towards the middle of the 17th century, in opposition to the Huguenots or Protestants. Those Methodists, from their different manner of treating the controversy with their opponents, may be divided into two classes. The one may comprehend those doctors, whose method of disputing with the Protestants was disingenuous and unreasonable, and who followed the examples of those military chiefs, who shut up their troops in intrenchments and strong holds, in order to cover them from the attacks of the enemy. Of this number were the Jesuit Veron, who required the Protestants to prove the tenets of their church by plain passages of scripture, without being allowed the liberty of illustrating those passages, reasoning upon them, or drawing any conclusions from them; Nihusius, an apostate from the Protestant religion; the two Walenburgs, and others, who confined themselves to the business of answering objections and repelling attacks; and cardinal Richelieu, who confined the whole controversy to the single article of the divine institution and authority of the church. The Methodists of the second class were of opinion, that the most expedient manner of reducing the Protestants to silence, was not to attack them by piecemeal, but to overwhelm them at once, by the weight of some general principle or presumption, some universal argument, which comprehended or might be applied to all the points contested between the two churches: thus imitating the conduct of those military leaders who, instead of spending their time and strength in sieges and skirmishes, endeavoured to put an end to the war by a general and decisive action. These polemics rested the defence of Popery upon prescription; the wicked lives of Protestant princes who had left the church of Rome; the crime of religious schism; the variety of opinions among Protestants with regard to doctrine and discipline; and the uniformity of the tenets and worship of the church of Rome. To this class belong Nicolle the Jansenist doctor, the famous Bossuet, &c.

Methodists

II. The *Protestant Methodists* form a very considerable body in this country; The sect was founded in the year 1729 by one Mr Morgan and Mr John Wesley. In the month of November that year, the latter being then fellow of Lincoln college, began to spend some evenings in reading the Greek New Testament, along with Charles Wesley student, Mr Morgan commoner of Christ church, and Mr Kirkham of Merton college. Next year two or three of the pupils of Mr John Wesley and one pupil of Mr Charles Wesley obtained leave to attend these meetings. Two years after they were joined by Mr Ingham of Queen's college, Mr Broughton of Exeter, and Mr James Hervey; and in 1735 they were joined by the celebrated Mr Whitefield, then in his 18th year.

At this time it is said that the whole kingdom of England was tending fast to infidelity. "It is come (says Bishop Butler), I know not how, to be taken for granted by many persons, that Christianity is not so much as a subject of inquiry, but that it is now at length discovered to be fictitious; and accordingly they treat it as if in the present age this were an agreement among all people of discernment, and nothing remained but to set it up as a principal subject of mirth and ridicule, as it were by way of reprisals, for its having so long interrupted the pleasures of the world." The Methodists are said, with great probability, to have been very instrumental in stemming this torrent. They obtained their name from the exact regularity of their lives; which gave occasion to a young gentleman of Christ church to say, "Here is a new set of *Methodists* sprung up;" alluding to a sect of ancient physicians which went by that name. This extreme regularity, however soon brought a charge against them, perhaps not altogether without foundation, of being too scrupulous, and carrying their sanctity to too great an height. In particular it was urged, that they laid too much stress upon the rubrics and canons of the church, insisted too much on observing the rules of the university, and took the scriptures in too literal a sense; and to the name of *Methodists* two others were quickly added, viz. those of *Sacramentarians* and the *Godly club*.

The principal person in this club while in its infancy appears to have been Mr Morgan, and next to him Mr John Wesley. They visited the sick, and instituted a fund for the relief of the poor; and the better to accomplish their benevolent designs, Mr Wesley abridged himself of all his superfluities, and even of some of the necessaries of life; and by proposing the scheme to some gentlemen, they quickly increased their funds to 80 l. *per annum*. This, which one should have thought would have been attended with praise instead of censure, quickly drew upon them a kind of persecution; some of the seniors of the university began to interfere, and it was reported "that the college censors were going to blow up the Godly Club *." They found themselves, however, patronised and encouraged by some men eminent for their learning and virtue; so that the society still continued, though they had suffered a severe loss in 1730 in the death of Mr Morgan, who had indeed been the founder of it. In the month of October 1735, John and Charles Wesley,

* See Wesley's Life, p. 105.

ley, Mr Ingham, and Mr Delamotte son to a merchant in London, embarked for Georgia along with Mr Oglethorpe, afterwards General Oglethorpe. The design of this voyage was to preach the gospel to the Indians. By this time, however, it appears, that Mr Wesley had embraced such notions as may without the least breach of charity be accounted fanatical. Thus in a letter to his brother Samuel, he conjures him to banish from his school "the classics with their poison, and to introduce instead of them such Christian authors as would work together with him in 'building up his flock in the knowledge and love of God."

During the voyage such a profusion of worship was observed, as we cannot help thinking savoured more of a Pharisaical than Christian behaviour; an account of which, as a similar strictness would certainly be inculcated upon the disciples, and consequently must give a just idea of the principles of the early Methodists, we shall here transcribe from Mr Wesley's Life. "From four in the morning till five each of us used private prayer; from five to seven we read the Bible together, carefully comparing it (that we might not lean to our own understandings) with the writings of the earliest ages; at seven we breakfasted; at eight were the public prayers; from nine to twelve learned the languages and instructed the children; at twelve we met to give an account to one another what we had done since our last meeting, and what we designed to do before our next; at one we dined; the time from dinner to four we spent in reading to those of whom each of us had taken charge, or in speaking to them separately as need required; at four were the evening prayers, when either the second lesson was explained (as it always was in the morning), or the children were catechised and instructed before the congregation; from five to six we again used private prayer; from six to seven I read in our cabin to two or three of the passengers, of whom there were about 80 English on board, and each of my brethren to a few more in theirs; at seven I joined with the Germans in their public service, while Mr Ingham was reading between decks to as many as desired to hear; at eight we met again, to instruct and exhort one another; between nine and ten went to bed, when neither the roaring of the sea nor the motion of the ship could take away the refreshing sleep which God gave us."

As they proceeded on their passage, this austerity instead of being diminished was increased. Mr Wesley discontinued the use of wine and flesh; confining himself to vegetables, chiefly rice and biscuit. He eat no supper; and his bed having been made wet by the sea, he lay upon the floor, and slept soundly till morning. In his Journal he says, "I believe I shall not find it needful to go to bed, *as it is called*, any more;" but whether this was really done or not, we cannot say.

The missionaries, after their arrival, were at first very favourably received, but in a short time lost the affections of the people entirely. This was owing to the behaviour of Mr Wesley himself, who appeared not only capricious but frequently despotic. He particularly gave offence by insisting upon the baptism of children by immersion; and his excessive austerity with regard to himself did not tend to give his hearers any favourable opinion either of the superior sanctity or wisdom of their teacher. At last, on account of a difference with Mr Causton the store-keeper and chief magistrate of Savannah, which ended in a law-suit, he was obliged to return to England.

Thus the cause of Methodism seemed to be entirely lost in Georgia. But Mr Wesley was soon succeeded by a more popular and successful champion, *viz.* Mr George Whitefield; who having spent his time during the voyage in converting the soldiers with whom he sailed, arrived at Savannah in Georgia on the 7th of May 1738. Here he was received by Mr Delamotte, was joined by several of Mr Wesley's hearers, and became intimate with some other ministers. Mr Ingham had made some progress in converting a few runaway Creek Indians, who had a settlement about four miles from Savannah; but being obliged to return to England in a few months, this design was frustrated, and the Indians in a few years separated. During the short time that Mr Whitefield resided at Savannah, he became extremely popular; and indeed the instances of his success in the way of making converts are very surprising. However, he was obliged to return to England in the autumn of that year, that he might receive priests orders. On his return to America in October 1739, he landed at Philadelphia, and instantly began his spiritual labours as in other places; being attended with astonishing success not only there but wherever he went. Passing through the colonies of Virginia, Maryland, North and South Carolina, the number of converts continually increased; but on his arrival at Savannah, he found the colony almost deserted. He now resumed the scheme he had formerly projected of building an orphan-house; and for this he made the first collection at Charleston in South Carolina, amounting to about 70 l. sterling. His zeal in the cause of religion, or of the colony, were not, however, sufficient to procure him the favour of those in power. On his return to Philadelphia, after a short stay at Savannah, the churches were denied him; but he was made ample amends by the success which attended his field preachings and private efforts. Religious societies were every where set up, and many were converted with symptoms of enthusiasm, different according to their various tempers and constitutions. During this excursion, he was so successful in his collection for the orphan-house, that on his return to Savannah he brought along with him money and provisions to the value of 500 l. sterling.

The success in Georgia was now greater than ever; but the many charities which it was necessary to supply, rendered it necessary in a short time for him to undertake another journey to Charleston. Here his principles met with the greatest opposition. He had lost the favour of the commissary by his field-preaching, and was denied the sacrament. The opposition, however, was altogether fruitless: the number of converts increased wherever he went, and he now undertook a voyage to New England. In this place also the established clergy were his enemies; but the usual success attended his other endeavours, and procured 500 l. more for the use of the orphans in Georgia.

From the year 1741 to 1742 America was deprived of Mr Whitefield's preachings, he having spent that interval in England; but in 1744 he again set out for the

Methodists the weſtern continent. The remarkable ſucceſs which had hitherto attended his labours, now ſtirred up many opponents; and theſe had met with the greater ſucceſs, as none of the Methodiſt preachers whom he had left, were poſſeſſed of ſuch abilities, either to gain the favour of thoſe who heard them, or to defend their doctrines againſt objections. Mr Whitefield's ſucceſs however, was the ſame as before: he even found means to inſpire the military claſs with ſuch ſentiments of devotion, that Colonel Pepperell could not undertake his expedition againſt Louiſbourgh, without firſt conſulting Mr Whitefield; and great numbers of New-Englanders went volunteers, confident of victory, in conſequence of the diſcourſes of their teacher.

From the continent of America, Mr Whitefield took a voyage to the Bermuda iſlands: and here, as every where elſe, he met with the moſt ſurpriſing ſucceſs. Here, alſo, collections were made for the Orphan-houſe in Savannah, which were tranſmitted to that place.

Suppoſing it to be better for his cauſe to viſit different countries, than to take up a permanent reſidence in one, Mr Whitefield left Bermudas in a few months, and did not return to America till 1751, when the Orphan-houſe was found to be in a very flouriſhing ſituation. After a ſhort ſtay, he ſet ſail again for Britain. Here he remained two years, and then ſet out on another viſit to America, landing at Charleſtown on the 27th of May, 1754. His preſence conſtantly revived the ſpirits and cauſe of his party, and added to their numbers wherever he went. Next year he returned to England; but after labouring in the uſual manner, and meeting with the uſual ſucceſs there till the year 1763, he ſet ſail again for America, and arrived at Virginia in the latter end of Auguſt. He now viſited all the colonies, and found that great progreſs had been made in converting the Indians. On his arrival at Georgia, matters were found in a very flouriſhing ſituation, and he received the thanks of the Governor and principal people, for the great benefit he had been to the colony; which ſhows, that the ſtories, which had been ſo induſtriouſly propagated, concerning the avarice of him and other Methodiſt preachers, were, partly at leaſt, unfounded. In 1765, he returned to England; and in 1769, made his ſeventh and laſt voyage to America, landing at Charleſtown on the 30th of November, the ſame year. He was ſtill attended with the ſame ſucceſs; and indeed it is impoſſible to read, without admiration, an account of the efforts made by himſelf and Mr Weſley, to propagate their tenets in the different parts of the world.

For a very conſiderable time, Mr Whitefield was the only Methodiſt who paid any attention to America: and in that country he was more popular than even in Europe. Towards the end of his life, ſeveral Methodiſts, having emigrated from Britain, formed diſtinct ſocieties in New-York and Philadelphia.—— Theſe quickly increaſed in number; and about the time that the war with Britain began, their numbers amounted to about 3000 in Virginia, Maryland, New-York, and Pennſylvania. They would probably have increaſed much more, had it not been for the imprudence of ſome of their preachers, who introduced politics into their diſcourſes, and thus rendered themſelves obnoxious to the people among whom they lived. Among thoſe who hurt the cauſe in this manner, was Mr Weſley himſelf, who, by writing a piece intitled, *A Calm Addreſs to the American Colonies*, would, in all probability, have ruined it, had not a gentleman, with whom he was connected, deſtroyed or ſent back to England, the whole impreſſion, as ſoon as it arrived in America, ſo that its exiſtence was ſcarce known in that continent. At the concluſion of the war, Dr Coke, who, in 1776, had left a curacy in England, in order to join Mr Weſley, paid a viſit to his friends in America; though it had been imagined that a total ſeparation had taken place between the American and European Methodiſts. This breach was, however, made up by a manœuvre of Mr Weſley; for no ſooner had the Americans obtained their independence, than he, who had hitherto branded them with the name of *rebels*, ſent a congratulatory letter on their freedom, from the "State and the Hierarchy," and exhorting them to "ſtand faſt in that liberty with which God had ſo ſtrangely made them free." To ſhow his zeal in their ſervice ſtill farther, he gave ordination, by laying on of hands, to ſeveral preachers who were to embark for America, and conſecrated Dr Coke one of the biſhops of the Methodiſt Epiſcopal church in that country. He extracted alſo from the liturgy of the Engliſh church one for the American Methodiſts, taking particular care to expunge every expreſſion that had a particular reſpect to the regal authority.

Such proceedings in one who had formerly profeſſed ſuch extraordinary attachment to the Engliſh church, could not but require an apology; and this was accordingly made in a paſtoral letter tranſmitted to the American ſocieties, and addreſſed "To Dr Coke, Mr Aſtbury, and our brethren in North-America." In this letter, he makes the following defence of his conduct: "Lord King's account of the primitive church convinced me, many years ago, that biſhops and preſbyters are the ſame order, and conſequently have the ſame right to ordain. For many years I have been importuned, from time to time, to exerciſe this right, by ordaining part of our travelling preachers. But I have ſtill refuſed, not only for the ſake of peace, but becauſe I was determined, as little as poſſible, to violate the eſtabliſhed order of the national church, to which I belonged. But the caſe is widely different between England and North-America. Here there are biſhops who have a legal juriſdiction; in America there are none, neither any pariſh-miniſters: ſo that, for ſome hundred miles together, there is none either to baptize, or to adminiſter the Lord's ſupper. Here, therefore, my ſcruples are at an end; and I conceive myſelf at full liberty, as I violate no order, and invade no man's right, by appointing and ſending labourers into the harveſt. It has indeed been propoſed to deſire the Engliſh biſhops to ordain part of our preachers for America: but to this I object. 1. I deſired the biſhop of London to ordain only one, but could not prevail. 2. If they conſented, we know the ſlowneſs of their proceedings; but the matter admits of no delay. 3. If they would ordain them now, they would likewiſe expect to govern them; and how grievouſly would that entangle us. 4. As our American brethren are now totally diſentangled, both from the ſtate and the Engliſh

glish hierarchy, we dare not entangle them again, either with the one or the other. They are now at full liberty simply to follow the scripture and the primitive church; and we judge it best, that they should stand fast in the liberty wherewith God has so strangely made them free."

Dr Coke, on the consecration of Mr Asbury to the office of a bishop, made another apology. "The church of England (says he), of which the society of Methodists have till lately professed themselves a part, did, for many years, groan in America, under grievances of the heaviest kind. Subjected to a hierarchy which weighs every thing in the scale of politics, its most important interests were repeatedly sacrificed to the supposed advantages of England.——The churches were in general filled with the parasites and bottle-companions of the rich and great. The humble and most importunate intreaties of the oppressed flocks, yea, the representations of a general assembly itself, were contemned and despised. Every thing sacred must bow down at the feet of a party; the holiness and happiness of mankind be sacrificed to their views; and the drunkard, the fornicator, and the extortioner, triumphed over bleeding Zion, because they were faithful abettors of the ruling powers. The memorable revolution has struck off these intolerable fetters, and broken the antichristian union which before subsisted between church and state. And had there been no other advantage arising from that glorious epoch, this itself, I believe, would have made ample compensation for all the calamities of the war; one happy consequence of which was, the expulsion of most of those hirelings, who "eat the fat, and clothed themselves with the wool, but strengthened not the diseased," &c. The parochial churches in general being hereby vacant, our people were deprived of the sacraments through the greatest part of these states, and continue so still. What method can we take in so critical a juncture? God has given us sufficient resources in ourselves; and after mature deliberation, we believe that we are called to draw them forth.

"But what right have you to ordain?" The same right as most of the churches in Christendom; our ordination, in its lowest view, being equal to any of the presbyterian, as originating with three presbyters of the church of England. "But what right have you to exercise the Episcopal office?" To me, the most manifest and clear. God has been pleased to raise up, by Mr Wesley, in America and Europe, a numerous society, well known by the name of *Methodists*. The whole body have invariably esteemed this man as their chief pastor under Christ. He has constantly appointed all their religious officers, from the highest to the lowest, by himself or his delegate. And we are fully persuaded, there is no church-office which he judges expedient for the welfare of the people entrusted to his charge, but, as essential to his station, he has power to ordain. "But, do you not break the succession?" The uninterrupted succession of bishops is a point that has long been given up by the most able Protestant defenders of Episcopacy. Bishop Hoadley himself, in his celebrated controversy with Dr Calamy, allows it to be unnecessary. His words are, 'To the 13th question I answer, that I think not an uninterrupted line of succession of regularly ordained bishops necessary.' He also grants the authenticity of the anecdote given us by St Jerom, which informs us, that the church of Alexandria had no regular succession from the time of St Mark the evangelist, the first bishop of that church, to the time of Dionysius, a space of 200 years; but the college of presbyters, on the death of a bishop, elected another in his stead We are also informed, from the epistle of St Clement to the Corinthians, written soon after the death of St Paul, a writer, whose works are next in precedence to the canon of scripture, and probably written by immediate inspiration, that the church of Corinth was then governed only by a college of presbyters. And from the epistle of Polycarp to the church of Philippi, written in 116, we also find, that the Christian Philippians were then governed only by a college of Presbyters. So that the primitive Christians were so far from esteeming the regular succession as essential to the constitution of a Christian church, that, in some instances, Episcopacy itself was wholly omitted."

Such was the defence urged by Mr Wesley for this extraordinary assumption of Episcopal powers: a conduct, however, of which he afterwards repented, as tending to make a final separation betwixt his followers and the church of England. Yet it does not appear that this had any bad effect on the minds of his American brethren; for Dr Coke, on his arrival on the western continent, found the societies numerous and flourishing. His first efforts were directed against the slave-trade; and not only the abolition of that traffic, but the release of all those who were actually slaves at the time, seem to have been his favourite objects. By interfering in this matter, however, perhaps with too much zeal, he involved himself in danger. Some riots took place; and a lady offered the mob 50 guineas if they would give the Doctor 100 lashes. This piece of discipline would have been inflicted, had it not been for the interposition of a sturdy Colonel; and the Doctor had not only the satisfaction of escaping the intended punishment, but of seeing his doctrine so far attended to, that some slaves were emancipated.

Mr Hanson, in his memoirs of Mr Wesley, observes, that "the colonists, in the infancy of Methodism, conducted themselves with more propriety than the English. There was little or no persecution, nor any thing like a riot, except in one or two instances, which have been mentioned as the consequences of the animadversions on slavery; and even these were productive of no mischief. Not a creature was materially injured; no bones were broken, nor any lives lost; which was not the case in this country. Here many thousands of innocent people were subjected to the grossest indignities, and several were eventually sacrificed to the fury of their persecutors.

"While we commend the Americans for their behaviour in opposition to the brutality of English mobs, it may be proper to inquire into the sources of this distinction. Something of this may have arisen from similarity of sentiment. The Americans from the first beginnings of colonization, had been accustomed to the doctrines of the old Puritans and Nonconformists, which, in many respects, have a near affinity to the Methodistic tenets. The origin of Methodism in America

Methodists. rica was seldom, if ever, attended, either under the discourses of Mr Whitefield's or Mr Wesley's preachers, with those ridiculous effects with which it was accompanied in these kingdoms. Most of the preachers who went over to the continent, having laboured for some years in Europe previous to their having crossed the water, had exhausted their wild-fire; so that their discourses were more spiritual and rational than those of the primitive Methodists. Another reason may be found in the education of the Americans. As a people, they are better cultivated than the body of the English; they are chiefly composed of merchants and a respectable yeomanry: and there is but a small proportion of that class, so superabundant here, which we distinguish by the name of *mob*.

"The only exceptions we have heard to their exemption from the extravagancies which in this country marked the infancy of Methodism, is a custom they have introduced in Maryland and Virginia. Frequently, at the conclusion of a sermon, the whole congregation begin to pray and to praise God aloud. The uproar which this must create may easily be conceived. Some, we are told, are great admirers of this species of enthusiasm, in which every man is his own minister, and one sings and another prays, with the most discordant devotion. But we will not dignify such indecency with such a name: its proper appellation is, *fanaticism*. We hope, that, for the future, religion will never appear in this country under so odious a form; and greatly is it to be lamented, that, among the friends of Christianity, any such absurdities should arise, to furnish infidels with occasion of triumph."

Our author informs us, that the occupation of the Methodist preachers in America was very laborious. In the course of the day, they frequently rode 20 or 30 miles, preaching twice or thrice, and sometimes to considerable congregations. Notwithstanding this labour, however, few or none of them ever thought of returning to Britain. Several reasons may be assigned for the pleasure they took in this laborious exercise. "Their excursions (says Mr Hanson) through immense forests, abounding in trees of all sorts and sizes, were often highly romantic. Innumerable rivers and falls of water; vistas opening to the view, in contrast with the uncultivated wild; deer now shooting across the road, and now scouring through the woods, while the eye was frequently relieved by the appearance of orchards and plantations, and the houses of gentlemen and farmers peeping through the trees; formed a scenery so various and picturesque, as to produce a variety of reflection, and present, we will not say to a philosophic eye, but to the mind of every reasonable creature, the most sublime and agreeable images.

"Their worship partook of the general simplicity. It was frequently conducted in the open air. The woods resounded to the voice of the preacher, or to the singing of his numerous congregations; while their horses, fastened to the trees, formed a singular addition to the solemnity. It was indeed a striking picture; and might naturally impress the mind with a retrospect of the antediluvian days, when the hills and vallies re-echoed the patriarchal devotions, and a Seth or an Enoch, in the shadow of a projecting rock, or beneath the foliage of some venerable oak, delivered his primeval lectures, and was a "preacher of righteousness to the people." Methodists.

The American hospitality is supposed by Mr Hanson to have been another reason for the assiduity of the Methodist teachers, as well as the consciousness of being well employed, and the satisfaction resulting from considerations of public utility. As many of the preachers were men of fervent piety, this reflection would have its full weight; and the instruction of the ignorant, and the reformation of the profligate, would be considered as the best recompence of their labours.—Spreading themselves through the continent, they took in Nova-Scotia, Georgia, with the principal places in both Carolinas, Virginia, Maryland, Delaware, Pennsylvania, New-Jersey, and New-York; numbering upwards of 43,000 members of their society, exclusive of about 80 itinerants, and a considerable number of local preachers, who took no circuits, but assisted occasionally in the neighbourhood of their respective residence.

The large and expensive buildings which the colonists have erected for public worship, almost exceed credibility; and several colleges are founded for the instruction of youth. How far the proposed plan of uniting genuine religion and extensive learning will be carried into execution, time only can discover. It must materially depend on the character of the presidents and tutors, and the provision that shall be made for their support. Men of real erudition, will never be procured at low salaries; and it is in vain to attempt establishments of this sort, without a liberal provision for the professors in every branch of science. Two of these places are called *Cokesbury* and *Wesley Colleges*.—How they are endowed, or whether they propose to obtain authority to confer degrees, we are not informed. But perhaps they are rather schools than colleges; which indeed is a circumstance to be wished, as good grammar-schools are of the utmost service to the progress of literature.

The great success which attended the Methodist preachers in America, naturally determined Mr Wesley to try the West-India islands. The Moravians had already attempted to establish their principles in some of these islands; and in 1786, some preachers were sent from the Methodists in England to the West-Indies. In many of these they met with success. Societies were formed in Barbadoes, St Vincent's, Dominica, St Christopher's, Nevis, Antigua, St Eustatius, Tortola, and St Croix, amounting in all to near 5000 persons. At this time the whole number of Methodists in America and the West-Indies, amounted to about 48,302. These societies consist both of whites and blacks: on the continent they were mostly whites, but in the islands negroes. "But it is to be observed, (says Mr Hanson), that the subjection of the negroes, and the obedience in which they are trained, must inculcate a docility peculiarly favourable to the purposes of a mission." Some of the missionaries went also to St Vincent's, where they met with some success, and have established some schools, in which their children are carefully instructed in the principles of religion.

"In January, 1789, (says our author), Dr Coke paid a visit to Jamaica, and gave them a few sermons,

Methodists. mons. As he made but a short stay, it could hardly be considered as a fair trial. Should a mission be established here, as well as in the other islands, which will probably be the case, it is hoped it will be the means of correcting one vice at least, and that is duelling; a savage relict of Gothic barbarity, by which all the islands have for many years been distinguished. Perhaps too, it will give some check to the spirit of luxury and dissipation; and teach the planters, if it be found impracticable to emancipate their slaves, at least to treat them with humanity."

It has been debated among the leading men of the Methodistical profession, whether the cause might not be served by sending missionaries to the East-Indies and to Africa; but these projects were dropped, as there was no invitation, nor any prospect of success if it had been adopted. A mission has been formed to the new settlement called *Kentucky*, on the confines of the Indian territories, near the Mississippi. The danger of the missionaries at the time they undertook this service, was certainly very great; yet such was their zeal for the cause, that they voluntarily offered themselves: but we are not yet informed what success they have met with.

While Methodism was thus making rapid progress in America, its teachers were equally indefatigable in Britain. A most remarkable particular, however, occurs with regard to Mr Wesley himself; for though he had gone to Georgia, as has been already related, to convert the Indians to Christianity, yet, on his return to England in 1738, he took it into his head that he, their teacher, was not yet converted: the reason was, that he had not the faith of assurance. This, however, was not long wanting. He arrived in England on the first day of February, and was blest with the assurance on the sixth of March following. This was immediately announced to the public; and the consequence, if we may believe him, was, that God then began to work by his ministry, which he had not done before. Being joined by one Kinchin, a fellow of Corpus, they travelled to Manchester, Holms Chapel, Newcastle in Staffordshire, and other places, where they preached, exhorted, and conversed on religious subjects, in public houses, stables, &c. sometimes meeting with success, and sometimes not. During this peregrination, Mr Wesley certainly displayed a great deal of superstition, which we must undoubtedly suppose to have been communicated to his hearers, and to have caused them to act on many occasions in a very ridiculous manner. An instance follows:—"The next day (says he), March 11th, we dined at Birmingham, and, soon after we left it, were reproved for our negligence there (in letting those who attended us go without either exhortation or instruction), by a severe shower of hail!" About the latter end of March, or the beginning of April, he and his companion began to pray *extempore*, leaving off entirely the forms of the church of England, to which he had formerly been so devoted. The doctrine of instantaneous conversion, which his imagination had suggested to him as a work performed on himself, was greedily received by some of his hearers, and all the converts to the new doctrine confirmed themselves, and contributed greatly to persuade others by declarations of their *experiences*, as they called them: however, though a knowledge of the saving assurance had been given on March 6th, he does not date his conversion sooner than May 24th, of the same year. Methodists.

This new doctrine of an instantaneous, and in fact miraculous impulse, though greatly relished by the enthusiastical part of the society, was very much disliked by others, particularly Mr Charles Wesley, his brother, who warned him of the mischief he was doing; though he himself was soon converted, and, what is very astonishing, two days before John Wesley himself. The particulars related of these miraculous conversions are truly disgraceful, and could not but bring into contempt the society which consisted of such enthusiasts. "Many (says Mr Hanson) are represented as falling suddenly to the ground, in horror and agony not to be conceived, and rising again with equal expressions of peace and consolation." Their conversions were usually attended with these violent symptoms; and, for several years, few meetings occurred where Mr Wesley presided, without one or more instances of the same kind. It was not possible that such transactions should pass without notice. The confusion that too often prevailed, the emotions of the persons affected, and the exultations of the rest, which were severally animadverted upon, gave great and general offence. Many insisted, that it must either be occasioned by the heat of the rooms, and the agitation of the animal spirits under discourses of the most alarming nature; or that it was mere artifice and hypocrisy.

In the mean time, two of the sons of a Mrs Hutton, in London, happening to become converts to the new doctrine, this lady was so much offended, that she wrote to Mr Samuel Wesley, informing him, that she was of opinion his brother John had lost his senses; and requesting, that the next time he came to his house, he, Mr Samuel, would either confine or convert him.—All that could be done, however, to prevent the progress of the new doctrine was insufficient; and the first Methodist society was formed in London, on the first of May, 1738, when about 50 agreed to meet together once a-week for free conversation, begun and ended with singing and prayer.

All this time, however, it seems that the conversion of Mr Wesley was far from being so complete as that of many of his hearers. He had preached and converted others, while he himself was absolutely unconverted. The knowledge of the true saving faith was only revealed to him on the 6th of March, and he did not experience its power till the 24th of May; and even after this, his doubts and fears were still so great, that on the 13th of June, he undertook a voyage to Germany, where, in the company of Count Zinzendorff, his faith seems to have been thoroughly confirmed.

On Mr Wesley's return, September 16th, 1738, he applied himself with the greatest assiduity and success, to the propagation of his doctrine. Multitudes of converts were made in various parts of the kingdom; and the reproaches poured upon him by his opponents, seemed to have rendered his zeal more fervent if possible than before. It is remarkable, however, that some of his old friends were now so much offended with his conduct or his principles, that they absolutely refused to keep company with him. His original

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original plan seems to have been, to make an union of clergymen, and disseminate his principles by their means. But in this he succeeded so ill, that in a letter written in 1742, he wished for a clerical assistant, were he only in deacons orders: but adds, "I know of none such, who is willing to cast in his lot with us; and I scarce expect I shall, because I know how fast they are rivetted in the service of the devil and the world before they leave the university." Finding at last that nothing could be done with them, he was obliged to have recourse to lay preachers; and easily selected those who appeared to have the greatest talents for prayer and exhortation in the private meetings appointed for that purpose. Thus he at once raised himself to be the head of a sect; as the lay preachers willingly yielded obedience to him who had the advantages of superior learning and abilities, and was besides in orders as a clergyman; and this obedience he did not fail on every occasion to exact.

If his doctrine had formerly given offence to the established clergy, the appointment of lay preachers was reckoned much worse; and their being appointed without any form of ordination whatever, which almost all of them were, subjected them to contempt and reproach, which their want of learning, and very often of natural abilities, did not contribute to remove. Thus finding the churches shut against him and his followers, he was obliged to preach in the fields, and made his first essay in this way on the second of April, 1739, in the neighbourhood of Bristol; Mr Whitefield having set him an example the day before.

The success of those ignorant and itinerant preachers, with their absurd and uncharitable discourses and behaviour, so provoked their adversaries, that a persecution was soon commenced against them. Mr Wesley himself was calumniated in the harshest manner, being sometimes said to be a Jesuit, sometimes an illiterate enthusiast, as the people took it into their heads. Many pretended to answer him in writing, without being able to do so: the consequence was that their deficiency of argument was supplied by invective, and the most scandalous performances made their appearance. Some of the English clergy so far forgot themselves as to instigate the mob against them, and the most cruel outrages were committed upon them in various places. For some time the persecuted party adhered to the doctrine of passive obedience and non-resistance, which their inhuman adversaries did not fail to take the advantage of.—The less they were opposed, the more insolent they became. The Methodists were frequently in danger of their lives. Men, women with child, and even children, were knocked down and abused with the same undistinguishing fury. Houses were stripped of their furniture, vast quantities of furniture carried off, feather-beds cut in pieces, and strewed over the streets, several reputable people were forced into the army, &c. To the disgrace of magistracy also, it was found, that when application was made to the justices of the peace, redress was commonly denied; nor was a stop put to these shameful proceedings without a royal mandate for the purpose.

From the year 1738 to 1747, Mr Wesley and his itinerants were employed in various parts of England. In 1747, he went over to Dublin, where a society had been formed by one Mr Williams a clergyman.—Here they proved so successful, notwithstanding the number of Papists, and the violence of their other opponents, that, in 1750, they had erected meeting-houses in every part of the kingdom, and had formed 29 circuits, which employed 67 itinerants, besides a considerable number of local preachers. An invitation was given to Mr Wesley, in 1751, to visit Scotland, by an officer in quarters at Musselburgh. He accordingly took a journey thither the same year; but left the place, after preaching in it once or twice. In 1753, he returned to Scotland, and visited Glasgow. Societies were at length formed in that city, as well as at Edinburgh, Dundee, Aberdeen, Inverness, and a few other places: but his success was by no means equal to what it had been in other parts; for in 1790, the number of circuits in Scotland was no more than eight, which were supplied by 20 itinerants.

Mr Whitefield, the other great labourer in the vineyard, was equally indefatigable, and probably more successful than Mr Wesley. Before entering into orders, he had formed a society of religious persons at Gloucester: here he preached his first sermon on the Necessity and Benefit of Religious Society; here he became extremely popular, as well as at Bristol and London, while preparing to set sail for Georgia for the first time; and in all places to which he came, large collections were made for the poor.—He maintained the same doctrine with Mr Wesley as to the new birth; which likewise gave offence to the clergy when delivered by him, as it had done with Mr Wesley. In the various intervals of his voyages to America, he employed himself with the very same assiduity in Britain and in Ireland, which we have already taken notice of in the western continent. His success was every where prodigious. In 1741, he was invited to Scotland, and preached his first sermon there at Dunfermline. From thence he went to Edinburgh, and preached in several of the established churches, but differed with Messrs Ralph and Ebenezer Erskines; so that he, as well as Mr Wesley, proved unsuccessful in forming a coalition with any other religious party. In the private way, however, his success was very considerable, at Edinburgh, Glasgow, Aberdeen, Dundee, and other places. In 1742, he paid a second visit to Scotland, a third one in 1748. In 1751, he visited Ireland for the first time; and preached to great multitudes, without being molested, even in places where others had been mobbed. From thence he returned to Scotland the same year, and speaks in very favourable terms of the attention the people there paid to their bibles. In 1752 and 1753, he again visited the same kingdom, and the last time distinguished himself by preaching against the playhouse in Glasgow. In 1756 he returned; and, by his animated discourses at Edinburgh against Popery and arbitrary power, was owned to have contributed very much to the increase of courage and loyalty in that country. Next year he again visited the Scottish capital, during the time that the general assembly sat, and his sermons were attended by several of the members. At Glasgow, he made a large collection for the poor of that city, and from thence took a voyage

Methodists

voyage to Ireland. He was received with the usual affection by the lower classes of Protestants; but the Popish rabble, exasperated at his success, almost murdered him with stones. After passing through a great part of Ireland, visiting England and Wales, he paid another visit to Scotland, where four clergymen now lent him their pulpits. His last visit was in the summer of 1758, where his congregations were as large as ever; and it is to his endeavours principally that we are to ascribe the great number of Methodist societies now existing in Scotland.

History of Methodism, &c.

With regard to the religious principles of the Methodists, we cannot enter into any particular detail: neither indeed are there any doctrines peculiar to all included under that name, except the single one of salvation by faith without works. In March, 1741, Mr Whitefield being returned to England, entirely separated from Mr Wesley and his friends, "because he did not hold the decrees." Here was the first breach, which warm men persuaded Mr Whitefield to make, merely for a difference of opinion. Those indeed who believed universal redemption, had no desire at all to separate: but those who held particular redemption, would not hear of any accommodation, being determined to have no fellowship with men that "were in such dangerous errors." So there were now two sorts of Methodists so called; those for particular, and those for general, redemption.

Not many years passed, before William Cudworth and James Relly, separated from Mr Whitefield.—These were properly Antinomians, absolutely avowed enemies to the law of God, which they never preached, or professed to preach, but termed all *Legalists* who did. With them, preaching the law was an abomination. They had nothing to do with the law. They would preach Christ, as they called it; but without one word either of holiness or good works. Yet these were still denominated *Methodists*, although differing from Mr Whitefield, both in judgment and practice, abundantly more than Mr Whitefield did from Mr Wesley.

In the mean time, Mr Venn and Mr Romaine began to be spoken of: and not long after Mr Maden and Mr Berridge, with a few other clergymen, who, although they had no connection with each other, yet preaching salvation by faith, and endeavouring to live accordingly, to be Bible-Christians, were soon included in the general name of *Methodists*. And so indeed were all others who preached salvation by faith, and appeared more serious than their neighbours. Some of these were quite regular in their manner of preaching: some were quite irregular, (though not by choice; but necessity was laid upon them, they must preach irregular, or not at all): and others were between both; regular in most, though not in all particulars.

In 1762, George Bell and a few other persons began to speak great words. In the latter end of the year they foretold that the world would be at an end on the 28th of February. Mr Wesley, with whom they were then connected, withstood them both in public and private. This they would not endure; so, in January and February, 1763, they separated from him, under the care of Mr Maxfield, one of Mr Wesley's preachers. But still Mr Maxfield and his adherents, even the wildest enthusiasts among them, go under the general name of *Methodists*, and so bring a scandal upon those with whom they have no connection.

At present, those who remain with Mr Wesley are mostly Church-of-England men. They love her articles, her homilies, her liturgy, her discipline, and unwillingly vary from it in any instance. Meantime all who preach among them declare, *we are all by nature children of wrath*, but *by grace we are saved through faith*; saved from both the guilt and from the power of sin. They endeavour to live according to what they preach, to be plain bible-Christians; and they meet together at convenient times, to encourage one another therein.—They tenderly love many that are Calvinists, though they do not love their opinions: yea, they love the Antinomians themselves; but it is with a love of compassion only, for they hate their doctrines with a perfect hatred: they abhor them as they do hell-fire: being convinced nothing can so effectually destroy all faith, all holiness, and all good works.

We shall conclude this article with the words of Mr Hanson, which must certainly be accounted just, whatever objections may be made to some parts of the principles or behaviour of the Methodists. "If they possess not much knowledge, which, however, we do not know to be the case, it is at least certain, they are not deficient in zeal: and without any passionate desire to imitate their example, we may at least commend their endeavous for the general good. Every good man will contemplate with pleasure the operation of the spirit of reformation, whether foreign or domestic; and will rejoice in every attempt to propagate Christianity in the barbarous parts of the world: an attempt which, if in any tolerable degree successful, will do infinitely more for their civilization and happiness, than all the united energies of those boasted benefactors of mankind, the philosophic infidels."

METHODISTS (*Methodici*), in the history of medicine, a sect of ancient physicians, who reduced the whole art of healing to a few common principles or appearances. The Methodists were the followers of Thessalus; whence they were also called *Thessalici*.—They were strenuously opposed by Galen in several of his writings; who scrupled not to assert, that the methodical heresy ruined every thing that was good in the art.

Quincy mistakenly uses *Methodists* (*Methodici*), for those physicians who adhere to the doctrine of Galen, and the schools; and who cure with bleeding, purges, &c. duly applied according to the symptoms, circumstances, &c. in opposition to empirics and chemists, who use violent medicines, and pretended secrets or nostrums.

METHODIUS, a father of the church, bishop of Olympus or Patara in Lycia, and afterwards of Tyre in Palestine, suffered martyrdom at Chalcis in Greece towards the end of Diocleſian's persecution in the year 302. He composed many works in a clear and elaborate style, which were extant in Jerome's time. Father Combefis collected several considerable fragments of this writer, cited by Epiphanius, Photius, and others;

others; and printed them with notes of his own, together with the works of Amphilochius, and Andreus Cretensis, in folio, Paris, 1644.

METHUSELAH, the son of Enoch, and father of Lamech, was born in the year of the world 687, begat Lamech in 874, and died in 1656, being the very year of the deluge, at the age of 969, which is the greatest age that has been attained to by any mortal man upon earth (Gen. v. 21, 22, &c.) According to the text of the septuagint, Methuselah must have lived 14 years after the deluge; and according to other copies, he died six years before it: but it is generally agreed on, that these copies, as well as the septuagint, are corrupted in this place.

METHYMNA (anc. geog.), a town of the island of Lesbos. It was the second city of the island in greatness, population, and opulence. Its territory was fruitful, and the wines it produced excellent. It was the native place of Theophrastus, and of Arion the musician. When the whole island of Lesbos revolted from the power of the Athenians, Methymna alone remained firm to its ancient allies.

METIUS (James), of Alcmaer, in Holland, the inventor of telescopes with glasses, one of which he presented to the States-General in 1609. Tubes, extended, by uniting them, to a great length, were known to the ancients; but Metius was the first who added glasses, and he was indebted to chance for the discovery: he had frequently observed some school-boys playing upon the ice, who made use of their copy books rolled up in the shape of tubes, to look at one another, to which they sometimes added pieces of ice at each end, to view distant objects: this led him to the invention of optic glasses.

METO, a famous mathematician of Athens, 432 B. C. published his *Anneadecatoride*, that is, his "Cycle of Nineteen Years," by which he endeavoured to adjust the course of the sun to that of the moon, and to make the solar and lunar years begin at the same point of time.

METŒCI, a name given by the Athenians to such as had their fixed habitations in Attica, tho' foreigners by birth. The *metœci* were admitted by the council of Areopagus, and entered in the public register. They differed both from the πολιται and ξενοι; because the *politæ*, or "citizens," were freemen of Athens, and the *xeni*, or "strangers," had lodgings only for a short time; whereas the *metœci*, though not freemen of Athens, constantly resided upon the spot whether they had removed.

METONYMY, in rhetoric, is a trope in which one name is put for another, on account of the near relation there is between them. See ORATORY, n° 51.

METOPE, in architecture, is the interval or square space between the triglyphs of the Doric freeze, which among the ancients used to be painted or adorned with carved work, representing the heads of oxen or utensils used in sacrifices.

METOPOSCOPY, the pretended art of knowing a person's disposition and manners by viewing the traces and lines in the face. Siro Spontoni, who has written expressly on metoposcopy, says, that seven lines are examined in the forehead, and that each line is considered as having its particular planet; the first is the line of Saturn, the second of Jupiter, the third of Mars, &c. Metoposcopy is only a branch of physiognomy, which founds its conjectures on all the parts of the body.

METRE, μετρεω, in poetry, a system of feet of a just length.

The different metres in poetry, are the different manners of ordering and combining the quantities, or the long and short syllables: thus hexameter, pentameter, iambic, sapphic verses, &c. consist of different metres or measures. See HEXAMETER.

In English verses, the metres are extremely various and arbitrary, every poet being at liberty to introduce any new form that he pleases. The most usual are the heroic, generally consisting of five long and five short syllables, and verses of four feet, and three feet, and a cæsura or single syllable.

The ancients, by variously combining and transposing their quantities, made a vast variety of different measures, by forming spondees, &c. of different feet. See POETRY.

METRETES, a Grecian measure, containing something more than nine English gallons. See MEASURE.

METRICAL VERSES, are those consisting of a determinate number of long and short syllables; as those of the Greek and Latin poets. Capellus observes, that the genius of the Hebrew languages is incompatible with metrical poetry.

METRODORUS, a Greek physician, born at Chios, was the disciple of Democritus the philosopher, and the master of Hippocrates the physician, and Anaxarchus the philosopher. He maintained, that the universe is infinite and eternal: but his works are lost. He lived about 444 B. C.

METROCOMIA (from μητηρ *mother*, and κωμη *town* or *village*), a term in the ancient church-history, signifying "a borough or village that had other villages under its jurisdiction." What a metropolis was among cities, a *metrocomia* was among country towns. The ancient *metrocomiæ* had each its choriepiscopus or rural dean, and here was his see or residence. See METROPOLIS and CHORIEPISCOPUS.

METRONOMII, the name given by the Athenians to five officers in the city and ten in the *piræus*, whose duty it was to inspect all sorts of measures, except those of corn. The *piræus* was the greatest mart in Attica.

METROPOLIS (from μητηρ *mother*, and πολις *city*), the capital of a country or province; or the principal city, and as it were the mother of all the rest.

The term METROPOLIS is also applied to archiepiscopal churches, and sometimes to the principal or mother-church of a city. The Roman empire having been divided into 13 dioceses and 120 provinces, each diocese and each province had its metropolis or capital city, where the proconsul had his residence. To this civil division the ecclesiastical was afterwards adapted, and the bishop of the capital city had the direction of affairs, and the pre-eminence over all the bishops of the province. His residence in the metropolis gave him the title of *metropolitan*. This erection of metropolitans is referred to the end of the third century, and was confirmed by the council of Nice,

Meulum || Meulen.

A metropolitan has the privilege of ordaining his suffragans; and appeals from sentences passed by the suffragans are preferred to the metropolitan.

METROPOLIS (anc. geog.), a town of Acarnania, a little to the south of Stratos. Another, of Lydia; situated between Colophon and Priene, near the Cayster. —A third of Phrygia; sacred to the mother of the gods, who was here worshipped.—A fourth Metropolis of Estiotis, a district in Thessaly, to the east of Gomphi, and the last town of that district. *Metropolitæ*, the people.

METULUM (anc. geog.), a considerable city of Liburnia, at the siege of which Octavius Cæsar was wounded. Said to be the metropolis, and situated on two eminences, intersected by a valley (Appian.) Now generally thought to be *Metling* in Carniola. E. Long. 16. N. Lat. 46. 5.

METZ, an ancient, large, and strong town of France, and capital of the territory of Messin, with a citadel, a parliament, and a bishop's see, whose bishop assumes the title of a prince of the empire. The cathedral church is one of the finest in Europe; and the square called *Coslin* and the house of the governor, are worth seeing. The Jews live in a part of the town by themselves, where they have a synagogue. The sweetmeats they make here are in high esteem. It is seated at the confluence of the rivers Moselle and Scille. E. Long. 6. 16. N. Lat. 49. 7.

METZU (Gabriel), an eminent painter, was born at Leyden, 1615. His subjects were usually taken from low life; but they were all designed after nature, and surprisingly well represented; such as women selling fish, fowls, or hares; sick persons attended by the doctor; chemists in their laboratories; dead game, painters rooms, shops, and drawing schools hung with prints and pictures; all which subjects he composed well, and finished them with extreme neatness, as he likewise did his portraits. He spent a great deal of time on his pictures, which has occasioned their scarcity and dearness at this time: and besides, it is confidently said, the Dutch prevent their being carried out of their own country, as much as possible. So that those paintings of Metzu, which are sometimes seen in the collections of other kingdoms, are either obtained by chance, or purchased at large prices. Though it ought also to be remembered, that the value set upon the works of this master throughout Holland and Flanders, has induced several painters to endeavour at imitating and copying his works, which having gradually circulated abroad, and being a little mellowed by time, are now called originals. He died in 1658.

MEVANIA (anc. geog.), a town of the Cisappenine Umbria; seated at the confluence of the Tina and Clitumnus, on the Via Flaminia, famous for its herds of white cattle brought up there for sacrifice; the white colour said to be owing to the waters of the Clitumnus (Virgil). Mevania was the country of Propertius, *Mevanates* the people. Now said to be *Bevagna*, in the territory of the Pope.

MEULEN (Anthony Francis Vander), painter of battles, &c. was born at Brussels in 1634; and was a disciple of Peter Sneyers, a battle-painter of considerable note. Some of his compositions happening to be carried to Paris, were shown to M. Colbert; who soon discerned the abilities of Vander Meulen, and by his generous offers induced him to leave his native city, and settle at Paris. Here he was employed by Louis XIV. and had an appointment of 2000 livres pension, besides being paid for his work. He attended that monarch in most of his expeditions in the field, and designed on the spot the sieges, attacks, encampments, and marches, of the king's armies, also the views of those cities and towns memorable by any degree of success; and from those sketches he composed the paintings, which were intended to perpetuate the remembrance of those military exploits. He died in 1690. The principal works of this master are at Versailles and Marli; but many of his easel pictures are dispersed through England, France, and Flanders.

Meursius.

MEURSIUS (John), a learned and laborious writer, born at Losdun, near the Hague, in 1579. He early discovered a fondness for polite literature and the sciences; and went to study the law at Orleans with the son of Barneveldt, whom he accompanied in his travels. In 1610, he was made professor of history at Leyden, and afterwards Greek professor. In the following year, the magistrates of the United Provinces proved how high their opinion was of his abilities, by fixing on him to write the history of his country. Meursius married in the year 1612. His wife, Anna Catherina Bilberbeccia, descended from a very ancient and noble family in Angermond, a city of Pomerania, possessed many amiable qualities, and rendered his domestic life remarkably happy, while he discharged the duties of his professorship with an assiduity equal to his abilities. At the same time the republic of letters did not lose the advantages to be derived from his labours; for during the fourteen years of his residence at Leyden, the works which he published were more numerous than those which had been presented to the world by the whole body of professors from the original foundation of the university in 1575.

Meursius's writings had now disseminated his reputation in every part of Europe; nor had the fame of his diligence and talents as a professor spread with less rapidity. In so high a rank, indeed, did he stand among his literary cotemporaries, that Christian IV. king of Denmark, conferred on him the place of historiographer royal, and invited him to undertake the professorship of history and politics in the academy of Sora, which was founded by king Frederick II. although the revival of its honours and dignities may be dated from this period, when it seemed to be again founded under the auspices of Christian IV. Meursius and his family left Leyden in the year 1635. On his arrival at Sora, he was received with the most friendly tokens of regard by his majesty and the Danish nobility, and more particularly by Chancellor Rosenkrantz, on whom he has bestowed very ample praises in one of his letters. Here he resided, equally beloved and admired, for above twelve years. His pupils were not very numerous, but his exertions never relaxed. Those hours likewise which were not devoted to the duties of his professorship, he employed in reviving the works of the ancients, and in philological disquisitions.

His health was not much impaired by the intenseness of application; but in the year 1638 he had a violent attack of the stone, from which disorder he had

Meurſius. had ſuffered ſeverely before. In a letter to Voſſius he thus deſcribes his melancholy condition: "The ſtate of my health during the whole of the laſt winter has been truly deplorable. My ſufferings from the ſtone have been realy dreadful. I have voided ſo many, that the repeated diſcharges brought on a wound which emitted blood for above four months. I was next attacked by a tertian fever, which increaſed conſtantly, and produced an univerſal laſſitude of body, a dejection of ſpirits, and a total loſs of appetite. But, thank heaven, I have now in ſome meaſure recovered my ſtrength, and gotten the better of theſe complaints." He recovered from this attack; but in the following year the diſorder returned with redoubled violence, and brought on a conſumption which terminated his exiſtence on the 20th day of September 1639. He left behind him a ſon who was named after him, and one daughter.

So mild were the diſpoſitions of Meurſius, that in all his writings he conſtantly avoided literary diſputes. He was ſometimes unavoidably drawn into them; but conſtantly endeavoured to promote a reconciliation, rather than widen any breach, by his replies to the attacks of his adverſaries. In his friendſhips he was firm and affectionate. Of his domeſtic life, whatever is known has been gathered from his letters. The ſame eaſy tranquillity ſeems to have attended him in every ſituation. In his family he was particularly fortunate. In his ſon, to whom he gave his own name, he ſeemed to behold his own youth renewed. The ſame application, the ſame eagerneſs in the purſuit of knowledge, marked the conduct of this promiſing young man; who did not long ſurvive his father, but died ſoon after he had recommended himſelf to the notice of the learned world by his publications. They were only three in number; but diſplayed ſo much ſolid learning, that they have been aſſigned to the father, John Meurſius, by Labbe Beughem and others. This miſtake was occaſioned as much by the ſimilitude of their names, as by the nature of their works, and their manner of treating philological ſubjects.

His works may be divided into four claſſes, of which each might form a ſeparate volume if they were ever to be republiſhed. Meurſius himſelf indeed, in one of his letters to Voſſius, propoſes ſuch a diviſion. From that epiſtle, and from another which the younger Meurſius ſent to G. I. Voſſius, who ſtrongly adviſed him to republiſh the whole of his father's writings, and from the collections of his poſthumous works which have appeared from Struvius, Groſchupſius, Moller, and ſome others, a catalogue of his works might be formed. Some aſſiſtance will alſo be derived from the indexes publiſhed in their reſpective works, by Hankius, Deſſelius, Wetterius, and Bartholinus. The plan which Meurſius recommends for publiſhing his works, is to inſert in the firſt volume all that he has written relative to Athens; in the ſecond, his hiſtorical pieces; in the third, his miſcellaneous diſſertations; and in the fourth, the various authors which he publiſhed, with his notes and corrections.

Before we conclude, one miſtake with reſpect to this great ſcholar, which prevails very generally, muſt be corrected. A ſcandalous and indecent work, which is intitled *Meurſii elegantiæ Latini ſermonis*, and has *Aloiſiæ Sigeæ Satyræ Sotadicæ* annexed to it is very falſely attributed to Meurſius; nor indeed are the *Satires* with more reaſon aſſigned to Aloiſia Sigea, who was a Spaniſh lady eminent for her piety and virtue. The real author of theſe infamous productions was Weſtrenius, an advocate at Copenhagen, who probably aſſumed the name of Meurſius, in order to ſhield himſelf from the diſgrace which would naturally have attended the writer of ſuch a performance. To inſure the ſale of his book, however, might have been the principal view of Weſtrenius. At any rate, ſuch a concluſion may be fairly deduced from the diſguiſed title, and from his deſire that the world ſhould affix it to a character ſo diſtinguiſhed and reſpectable in almoſt every branch of various literature.

Mew || Mexico.

MEW, Sea-mew, or *Sea-mall*. See Larus.

Winter-Mew, or Coddy-moddy, in ornithology. See Larus.

MEWING, the falling off or change of hair, feathers, ſkin, horns, or other parts of animals, which happens in ſome annually, in others only at certain ſtages of their lives: but the generality of beaſts mew in the ſpring. An old hart caſts his horns ſooner than a young one, which is commonly in the months of February and March, after which they begin to button in March or April: and as the ſun grows ſtrong, and the ſeaſon of the year puts forth the fruits of the earth, ſo their heads grow, and are ſummed full by the middle of June. It is to be obſerved, that if a hart be gelt before he has a head, he will never have any; and if he be gelt after he has a head, he will never caſt his horns; again, if he be gelt when he has a velvet-head, it will always be ſo, without fraying or burniſhing.

MEXICO, a province of the Spaniſh empire in America, once a celebrated kingdom, the moſt powerful and civilized in the New World.

I Kingdoms into which Mexico was anciently divided.

In former times the country now diſtinguiſhed by the name of the *Vale of Mexico*, was called *Anahuac*, the reſt of it being divided into the kingdoms of *Mexico*, *Acolhuacan*, *Tlacopan*, and *Michuacan*; the republics of *Tlaxcallan*, *Cholollan*, *Huexotzinco*, and ſome other ſtates. Of theſe the moſt weſterly was Michuacan, which to the eaſt and ſouth had Mexico; on the north the country of the Chichemecas, and ſome other barbarous nations; on the weſt the lake of Chapallan, and ſome independent tribes. Had four conſiderable cities; the capital being ſeated on the eaſtern ſhore of a beautiful lake named *Pazcuaro*. The kingdom of Tlacopan lay betwixt Mexico and Michuacan, and was of very ſmall extent; its capital was ſeated on the weſtern border of a lake called *Tezcuco*, four miles weſtward of that of Mexico. Acolhuacan was the moſt extenſive as well as the moſt ancient. It was bounded on the eaſt by the republic of Tlaxcallan; on the ſouth by a province of Mexico named Chalco; on the north by the country of the Huaxtecas; and on the weſt by other ſtates of Mexico, terminating at the lake Tezcuco. Its length from ſouth to north was ſomewhat more than 200 miles, and its breadth about 60; it was very populous, and had a great many cities. On the eaſtern bank of the lake of Tezcuco was ſituated the capital of that territory, 15 miles to the eaſtward of that of Mexico; and no leſs celebrated for its antiquity than the politeneſs and civilization of its inhabitants. Tlaxcallan, or Tlaſcala, a celebrated republic, had Acolhuacan to the weſt; the

Mexico.

the republics of Chololan and Huexotzinco to the south; and some of the Mexican states on the north and east. It was but of small extent; not reaching more than 50 miles in length and 30 in breadth. Its capital stood on the side of a great mountain, about 70 miles to the eastward of Mexico. The kingdom of Mexico, though the most modern, came at last to be the most extensive of the whole. On the south and south-west it extended as far as the Pacific Ocean; on the east it was bounded by the republics of Tlacopan and Michuacan; on the north by the country of the Huextacas; and on the north-west by the country of the Chichemecas; the whole being comprehended between the 14th and 21st degrees of north latitude, and between 271 and 283 of longitude, computed from the meridian of Ferro.

2 Uncertainty of the origin of the Mexicans.

If the origin of the nations on the eastern continent is obscure, that of the inhabitants of the western continent is much more so; and indeed, till very lately, the history of every one of the American nations, till the arrival of the Spaniards, has been either treated as entirely fabulous, or very slightly touched upon by historians. By the industry of the Abbé Francisco Clavigero, however, we are now furnished with an account of the ancient kingdoms just enumerated; more full and authentic than could have been expected, considering the difficulty there must have been of procuring materials.

3 They came from the north.

According to this gentleman, it is undeniable that Mexico was first peopled from the more northerly parts of the continent, which for many ages had been filled with inhabitants. Some have supposed, from the traditions of the natives, and the discovery of very large human skeletons in many parts of New Spain, that this country was first inhabited by giants: but though similar conjectures and discoveries have been made in other countries, we are by no means warranted from thence to conclude that the whole human race were formerly of an immense size; it being most probable, as our author observes, that the gigantic race were but a few individuals who lived at different times and in different nations.

4 Toltecans the first inhabitants.

The Toltecans are the most ancient Mexican nation of which we know any thing. They were expelled, as we are told, from their own country (supposed by Clavigero to have been *Tollan*, to the northward of Mexico) in the year 472; and for some time led a migratory and wandering life. In whatever place they determined to reside for any considerable time, they erected houses and cultivated the ground. Thus their migrations were extremely slow, and it was not till 104 years after they set out that they reached a place about 50 miles to the eastward of the city of Mexico, where they settled for 20 years, giving to their new place of residence the name of *Tollantzinco*. From thence they proceeded about 40 miles farther to the west, where they built a city called, from the name of their country, *Tollan*, or *Tula*.

5 Their history.

The Toltecans, during their journeys, were conducted by a number of chiefs; who by the time they arrived at Tollantzinco, were reduced to seven, and, after their final settlement, the government was changed into a monarchy; but by what means, or on what account, we are not told. Their first king began his reign in 667, and their monarchy lasted 384 years, during which time they reckon just eight princes. We are not, however, to imagine that each of their kings lived long enough to make up this space. It was a custom among them that the name of the king should be continued for 52 years, and no longer, from the time he ascended the throne. If he died within that period, the government was carried on in his name by a regency; if he survived, he was obliged to resign his authority. During the four centuries that the Toltecan monarchy continued, they had increased very considerably in number, and had built many cities; but when in the height of prosperity, almost the whole nation was destroyed by a famine occasioned by drought; and a pestilence, probably the consequence of the former. "According to Torquemada (says our author), at a certain festival-ball made by the *Toltecas*, the *sad looking* devil appeared to them of a gigantic size, with immense arms, and in the midst of the entertainment he embraced and suffocated them; that then he appeared in the form of a child with a putrid head, and brought the plague; and, finally, at the persuasion of the same devil, they abandoned the country of Tula."

These stories, according to Clavigero, are taken from the symbolical representations or hieroglyphics, by which this piece of history was represented, and which the Spanish author has taken literally. Be the cause what it will, however, it is certain that the surviving Toltecans abandoned their country, and dispersed themselves among the surrounding nations, where they were well received, on account of their superior knowledge and civilization. They were succeeded by the Chichemecas, a much more barbarous people, who came from an unknown country called *Amaquemecan*, where they had for a long time resided; but of which no traces or remembrance can be found among any of the American nations known to Europeans; so that Clavigero supposes it must have been very far to the northward.

6 Succeeded by the Chichemecas.

The motive which the Chichemecas had for leaving their own country is not known. They were eighteen months on their journey, and took possession of the desolate country of the Toltecas about an hundred years after the former had left it. They were much more uncivilized than the Toltecans; but, however, had a regular form of monarchical government, and in other respects were less disgusting in their manners than some of the neighbouring nations. The last king who reigned in Amaquemecan before the departure of the Chichemecas, had left his dominions between his two sons Auchcauhtli and Xolotl, and the latter conducted the new colony. Having proceeded from the ruins of Tula towards Chempoalla and Tepepolio, Xolotl sent his son to survey the country. The prince crossed the borders of the lakes and the mountains which surround the vale of Mexico; then ascending to the top of a very high one, he viewed the whole country, and took possession of it in the name of his father, by shooting four arrows to the four winds.

7 Xolotl their first king.

Xolotl being informed by his son of the nature of the country, chose for the capital of his kingdom Tenayuca, about six miles to the northward of the city of Mexico, and distributed his people in the neighbouring territory; but as most of them went to the northward, that part obtained the name of the country

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try of the Chichemecas, in distinction from the rest. Here a review of the people was taken, and their number, according to Torquemada, was more than a million. In confirmation of this the historian adds, that in his time there were still remaining twelve piles of the stones they threw to ascertain their numbers; but Clavigero thinks it improbable that so large an army should set out on so long an expedition, or that so small a district could maintain so many hunters.

Xolotl finding himself peacefully settled in his new dominion, sent one of his officers to explore the sources of some of the rivers of the country. While performing this task he came to the habitations of some Toltecans, who it seems had still kept together, and were likely once more to become a nation. As these people were not inclined to war, and greatly esteemed for their knowledge and skill in the arts, the Chichemecas entered into a strict alliance with them, and Prince Nopaltzin, who had first surveyed the country, married a Toltecan princess. The consequence of this alliance was the introduction of the arts and knowledge of the Toltecans among the Chichemecas. Till now the latter had subsisted entirely by hunting, and such fruits and roots as the earth spontaneously produced. They were clad in the skins of wild beasts, and, like these beasts, they are said to have sucked the blood of the animals they caught; but after their connection with the Toltecans they began to sow corn, to learn the art of digging and working metals, to cut stones, manufacture cotton, and, in every respect, to make great improvements.

8 His people civilized by the Toltecans.

9 New inhabitants arrive and obtain settlements.

When Xolotl had reigned about eight years in his new territories, an embassy of six persons arrived from a distant country not far from *Amaquemecan*, expressing a desire of coming with their people to reside in the country of the Chichemecas. The king gave them a gracious reception, and assigned them a district; and, in a few years after, three other princes, with a great army of Acolhuans, who were likewise neighbours of Amaquemecan, made their appearance. The king was at that time at Tezcuco, to which place he had removed his court: and here he was accosted by the princes, who, in a submissive and flattering manner, requested him to allow them a place in his happy country, where the people enjoyed such an excellent government. Xolotl not only gave them a favourable reception, but offered them his two daughters in marriage, expressing his concern that he had no more, that none might have been excluded from the royal alliance. On the third prince, however, he bestowed a noble virgin of Chalco, in whom the Toltecan and Chichemecan blood were united. The nuptials were celebrated with extraordinary pomp; and the two nations, after the example of the sovereigns, continued to intermarry. As the Acolhuans were the more civilized nation of the two, the name of Chichemecas began to be appropriated to the more rude and barbarous part, who preferred hunting to agriculture, or who chose a life of savage liberty in the mountains to the restraints of social laws. These barbarians associated with the Otomies, another savage nation who lived to the northward, occupying a tract of more than three hundred miles in extent; and by their descendants the Spaniards were harassed for many years after the conquest of Mexico.

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10 Division of the dominions of Xolotl.

As soon as the nuptial rejoicings were over, Xolotl divided his territories into three parts, assigning one to each of the princes. Acolhuatzin, who had married his eldest daughter, had Azcopazalco, 18 miles to the westward of Tezcuco; Chiconquauhtli, who married the other, had a territory named Xaltocan; and Tzontecomatl, who married the lady of inferior rank, had one named Coatlichan. The country continued for some time to flourish, population increased greatly, and with it the civilization of the people; but as these advanced, the vices of luxury and ambition increased in proportion. Xolotl found himself obliged to treat his subjects with more severity than formerly, and even to put some of them to death.—This produced a conspiracy against him, which, however, he had the good fortune to escape; but while he meditated a severe revenge on the conspirators, he was seized with the distemper of which he died, in the fortieth year of his reign, and in a very advanced age. His corpse was adorned with various figures of gold and silver, and placed in a chair made of gum copal and other precious substances, where it remained five days, until the lords summoned to the funeral attended. The body was then burnt, and the ashes deposited in an urn of the hardest stone. This urn was kept exposed in the palace for forty days, during which time the nobility attended with lamentations; after which it was carried to a cave in the neighbourhood, with similar demonstrations of grief.

11 Nopaltzin the second king.

Xolotl was succeeded by his son Nopaltzin, who at the time of his accession is supposed to have been about sixty years of age. In his time, the tranquillity of the kingdom, which had begun to suffer disturbance under his father, underwent much more violent shocks, and civil wars took place. Alcohuatzin, the only one of the three princes who remained alive, thinking the territory he possessed too narrow, made war upon the lord of a neighbouring province named Tapotzotlan, and deprived him of his territory. Huetzin, son to the late prince Tzontecomatl, lord of Coatlichan, fell in love with the grand-daughter of the queen, a celebrated beauty, but was rivalled by a neighbouring lord, who determined to support his pretensions by force of arms. Huetzin, however, got the better, defeated and killed his adversary, and then possessed himself of the lady and his estate. This was followed by a rebellion of the whole province of Tollantzinco, so that the king himself was obliged to take the field. As the rebels were very numerous, the royal army was at first defeated; but having at last received a strong reinforcement, the rebels were overcome, and their ringleaders severely punished. The king did not long survive the restoration of tranquillity to his dominions. He died in the thirty second year of his reign, and ninety-second of his age, leaving the throne to his eldest son Tlotzin.

12 Civil wars.

13 Tlotzin.

We are not informed of any particulars relating to this prince farther than he was of an excellent disposition, greatly beloved by his subjects, and, though addicted to peace, yet assiduous in exercising his people in the art of war. He reigned thirty-six years, and died of a very painful disease.

14 Quinatzin a luxurious prince.

Quinatzin, the son and successor of Tlotzin, proved a vain and luxurious prince. His accession to the throne was celebrated with much greater pomp than

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any of his predeceſſors. Xolotl had removed his court from Tenayuca to Tezcuco; but being diſguſted with this laſt place, on account of the conſpiracy formed againſt him there, he had returned to Tenayuca.—There the court continued till the reign of Quinatzin, who removed it back to Tezcuco. In his paſſage thither, he cauſed himſelf be tranſported in an open chair or litter, carried on the ſhoulders of four of his principal lords, while four others held an umbrella over his head. Before his time the kings had been accuſtomed to walk upon their feet like other people; but this example, once ſet, was quickly followed by all the lords and great people in the kingdom, who now ſtrove to out-do one another in expenſive and oſtentatious grandeur.

15 Diſturbances in various parts.

The reign of Quinatzin, though tranquil at firſt, was ſoon diſturbed by dangerous revolts and rebellions. Theſe firſt broke out in two ſtates, named Maztillen and Totopec, ſituated among the northern mountains. The king, having collected a great army, marched without delay againſt the rebels, and challenged their leaders to come down and fight him in the plain.—This challenge being accepted, a furious engagement enſued, in which, though great numbers fell on both ſides, no deciſive advantage was gained by either party. Frequent engagements took place for the ſpace of forty days, until at laſt the rebels, perceiving that their own number were daily diminiſhing, without any poſſibility of being recruited like the royal army, made a final ſurrender to the king, who puniſhed the ringleaders with great ſeverity. Tranquillity, however, was not yet reſtored: the rebellion ſpread to ſuch a degree, that the king was obliged not only to take the field in perſon, but to employ ſix other armies, under the command of faithful and experienced generals, to reduce the rebels. Thoſe proved ſo ſucceſsful in their enterprizes, that in a ſhort time the rebellious cities were reduced to obedience, and the kingdom enjoyed the bleſſings of peace during the long reign of Quinatzin, who is ſaid to have ſat on the throne for no leſs than ſixty years. He was ſucceeded by his ſon Techotlatla; but as the affairs of the Acolhuans now began to be connected with thoſe of the Mexicans, it will be proper to give ſome account of that people.

16 Migrations of the Mexicans.

The Mexicans, called alſo the Aztecas, dwelt till the year 1160 in a country called *Aztlan*, ſituated to the north of the gulf of California, as appears by the route they purſued in their journey: but how far to the northward we are not certainly informed. Betancourt makes it no leſs than 2700 miles, and Boturini ſays it was a province of Aſia. The cauſe of their migration is ſaid to have been as follows:

Among the Aztecas was a perſon of great authority, named *Huiztilin*, to whoſe opinion every one paid the utmoſt deference. He had conceived a deſign, for what reaſon we know not, to perſuade his countrymen to change their reſidence; and to effect this he fell upon the following ſtratagem. Having heard, while meditating on his ſcheme, a little bird ſinging on the branches of a tree, the notes of which reſembled the word *Tihui*, which in the Azteca language ſignified "let us go," he took that opportunity to work upon the ſuperſtition of the people. With this view, he took along with him a reſpectable perſon, and made him attend to the note of the bird. "What can it mean (ſays he), but that we muſt leave this country, and find ourſelves another? Without doubt it is the warning of ſome ſecret divinity who watches over our welfare: let us obey, therefore, his voice, and not draw his anger upon us by a refuſal." Tecpaltzin, for that was the name of his friend, readily agreed to the interpretation; and both of them being perſons of great influence, their united perſuaſions ſoon gained over to their project the bulk of the nation; and they accordingly ſet out.

This account, though it has ſomewhat the air of fable, is what the Mexicans themſelves give; and is certainly more worthy of credit than that of the Spaniards, who maintain that the Aztecas ſet out by the expreſs command of the devil. But whatever was their motive, it is certain that they began their migration about the year abovementioned. Torquemada ſays, that in all the hieroglyphic paintings which record this migration, there is delineated an arm of the ſea, or a great river, which however, Clavigero takes to be a repreſentation of the univerſal deluge. Boturini ſuppoſes it to have been the gulf of California, over which, he thinks, they tranſported themſelves; but our author controverts this opinion, becauſe there are no remains of the buildings they conſtructed, during their migration, in California as there are in other places. If there really was any river of conſequence which they croſſed, he ſays it muſt have been the *Colorado*, or Red River, which diſcharges itſelf into the gulf of California, in lat. 32°. 30. Having croſſed this beyond the lat. of 35°. they proceeded towards the ſouth-eaſt, as far as the river *Gila*, where they ſtopped for ſome time; and on the banks of that river there are remains of the great edifices they conſtructed. From thence having reſumed their courſe towards the S. S. E. they proceeded to lat. 29°. and ſtopped again at a place upwards of 250 miles diſtant from the city of Chihuahua, towards the N. N. W. This place is now known by the name of *Caſe grandi*, on account of a very large building ſtill extant, and univerſally attributed to them by the traditions of the country. It is conſtructed on the plan of thoſe of New Mexico, that is, conſiſting of three floors with a terrace above them, and without any entrance to the under floor. The door for entrance opens to the ſecond floor; ſo that a ſcaling ladder is neceſſary: and the inhabitants of New Mexico build in this manner, in order to be leſs expoſed to the attack of their enemies; putting out the ſcaling ladder only for thoſe to whom they give admiſſion into their houſes. No doubt the Aztecas had the ſame motive for raiſing their edifice on this plan, as every mark of a fortreſs is to be obſerved in it, being defended on one ſide by a lofty mountain, and the reſt ſurrounded by a wall about ſeven feet thick, the foundations of which are ſtill exiſting. In this there are ſtones as big as mill-ſtones; the beams of the roof are of pine, and well finiſhed. In the centre is a little artificial mount, apparently conſtructed with a deſign to keep guard on, and obſerve the enemy. Some ditches have been formed in this place, and ſeveral kitchen utenſils found, as earthen pots, diſhes, and jars, with ſome looking-glaſſes made of a ſtone called *iiztli*.

The Atzecas having ſtaid here as long as they thought

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thought proper, crossed the mountains of Tarahumara, directed their course southward, and stopped again for three years at Culiacan, a place situated on the gulf of California in 24 degrees north latitude. Here they formed a wooden image of a god called *Huitzilopochtli*, whom they imagined to be their tutelar deity, and made a chair of reeds and rushes to transport it calling this vehicle *the chair of God*. Four priests were chosen, to carry the image on their shoulders, whom they called *the servants of God*; and the act of carrying it they name *teomama*, which signifies "to carry *God* on ones *back*."

17 Separation of the tribes.

The Aztecas, when they left their original habitations, were divided into six tribes; but here the Mexicans were left with their god by five of them, viz. the Xochimilcas, Tepanecas, Chalcese, Tlahuicas, and Tlascalans. The cause of this separation is not known. The tribes just mentioned pretend that it was done at the express command of God; but there can be little doubt that it was occasioned by some disagreement among themselves. This is rendered farther probable, when we consider that on their journey towards Tula, the remaining tribe was divided into two violent factions, which alternately persecuted one another: neither did they afterwards construct any more edifices. However, they always travelled together, in order to enjoy the company of their imaginary God. At every place where they stopped an altar was erected to him; and at their departure they left behind them all their sick, and probably also some others to take care of them, or such as were not willing to endure the fatigue of farther journeys. They stopped in Tula nine years, and eleven more in the neighbouring parts. At last, in 1216, they arrived at Zumpanco, a considerable city in the vale of Mexico, where they were received in a very hospitable manner by the lord of that district. He not only assigned them proper habitations, but became very much attached to them; and even demanded from among them a wife for his son Ilhuicatl. This request was complied with; and from this marriage all the Mexican kings descended

The Mexicans continued to migrate from one place to another along the lake of Tezcuco. Xoltotl, who was then on the throne of the Acolhuans or Chichemechas, allowed them to settle in whatever places of his dominions they thought proper; but some of them

18 The Mexicans persecuted,

finding themselves harassed by a neighbouring lord, were obliged, in 1245, to retire to Chapoltepec, a mountain on the western borders of the lake, scarce two miles distant from the site of Mexico. This took place in the reign of Nopaltzin; when, as has already been observed, disturbances began to take place in the Acolhuan dominions. The Mexicans, however, did not find themselves any more secure in their new place of residence than formerly: they were persecuted by the neighbouring lords, and obliged to take refuge in a number of small islands, named *Acocolco*, at the southern extremity of the lake of Mexico. Here for 52 years they lived in the most miserable manner that can be imagined; subsisting on fish, insects, roots, &c. and clothing themselves with the leaves of the amoxtli, which abounds in that lake.

19 And enslaved.

In this miserable plight the Mexicans continued till the year 1314, when they were all reduced to a state of the most absolute slavery. This was done by the king of a petty state named Colhuacan: but there are different accounts of the manner in which it was effected. Some say that this prince, unwilling to allow the Mexicans to maintain themselves in his territories without paying tribute, made war upon them, subdued and enslaved them. Others affirm, that, pretending compassion for their miserable situation, he offered them a more commodious place of residence. The Mexicans accepted the offer with great pleasure; but had scarcely set out to take possession of their new place of residence when they were attacked by the Colhuans, made prisoners, and carried off for slaves.

20 They regain their liberty in consequence of a monstrous piece of cruelty.

After some years a war broke out betwixt the Colhuans and Xochimilcas; in which the latter gained such advantages, that they were obliged to employ their slaves to assist them. They accordingly ordered them to prepare for war, but without furnishing them with arms necessary for a military enterprise; so that the Mexicans were obliged to content themselves with long staves, having their points hardened in the fire: they also made knives of the stone itztli, and shields of reeds woven together. They agreed among themselves not to waste their time, as was usual, in making prisoners, but to content themselves with cutting off one ear of their enemies, and then leaving them without farther injury, They adhered punctually to this resolution; and rushing furiously upon the Xochimilcas, cut off an ear from as many as they could, killing those who struggled to such a degree that they could not effect their purpose. In short, so well did the Mexicans acquit themselves in this engagement, that the Xochimilcas not only abandoned the field, but were obliged to take refuge among the mountains. After the battle, the Colhuan soldiers presented themselves before their general with the prisoners they had taken; for it was by the number of these, not of the enemy left dead on the field, that they judged of their valour. The Mexicans had taken only four, and these they kept concealed for the abominable purpose of sacrificing them. The Colhuans, therefore, seeing no trophies of their valour, began to reproach them with cowardice; but the Mexicans, producing their baskets of ears, desired them to judge from these how many prisoners they might have taken, had they not been unwilling to retard their victory by taking up time in binding them.

Notwithstanding the valour displayed by the Mexicans in this engagement, it doth not appear that their haughty masters were in the least mollified or inclined to afford them easier terms than before. Having erected an altar to their god, they demanded of their lord something precious to offer in sacrifice to him; but he in disdain sent them a dirty cloth, inclosing the filthy carcase of a vile bird. This was carried by Colhuan priests; and without any ceremony laid upon the altar. The Mexicans, with apparent unconcern, removed this filthy offering, and put in its place a knife

21 The first human sacrifice in Mexico.

made of itztli, and an odoriferous herb. On the day of consecration, the Colhuan prince failed not to attend with his nobility; not with a view to do honour to the festival, but to make a mockery of the Mexicans. Their derision, however, was soon changed into horror, when the Mexicans, after a solemn dance, brought forth the four Xochimilcan prisoners they had taken; and, after having made them dance a little, cut open their

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their breasts with the knife which lay on the altar, and plucking out their hearts, offered them, while yet warm and palpitating with life, to their diabolical idol. This horrible sacrifice had such an effect upon the spectators, that both king and subjects desired the Mexicans immediately to quit their territories and go where they pleased. This order was instantly obeyed: the whole nation took their rout towards the north, until they came to a place named *Acatzitzintlan*, situated betwixt two lakes, and afterwards named *Mexicalizinco*; but for some reason or other, being discontented with this situation, as indeed they seem very often to have been, they proceeded to *Iztacalco*, still nearer to the site of Mexico. Here they formed the image of a little mountain of paper, and danced round it a whole night, singing their victory over the Xochimilcas, and returning thanks to their god for having freed them from the yoke of the Colhuas. Clavigero is of opinion, that by this mountain they represented Colhuacan, as in their pictures it was always represented by a hunch-backed mountain; and this is the literal signification of the name.

22 They settle at last on the islands on which Mexico was built.

Having staid two years in Iztacalco, they came to a place on the lake where they found a nopal or opuntia growing in a stone, and over it the foot of an eagle. All the Mexican historians say that this was the mark given them by their oracle of the place where they were finally to settle. Here, then, they put an end to their wanderings; and, as soon as they had taken possession of the spot, an altar was erected to the god, or rather devil, whom they worshipped. The altar was consecrated in a manner conformable to the cruel religion which these people had adopted. Having at that time no prisoners among them, one of their number went out in quest of some animal for a victim; but happening to meet with a Colhuan, a quarrel ensued; and the Mexican proving victorious, bound his enemy, brought him home, and presented his heart to the idol. Around this altar they now began to build their habitations; which, like the celebrated city of Rome, consisted at first of a parcel of miserable rush huts; as they were then furnished with no better materials. Their city, if such it might be called, was named *Tenochtitlan*, and afterwards *Mexico*, which name afterwards prevailed; and, according to Clavigero, signifies the place of *Mexitli* or *Huitzilopochtli*, their god of war: and in this respect also the founding of Mexico was similar to that of Rome, the latter being protected by *Mars* their god of war, as the Mexicans were by *Mexitli*.

23 Their miserable situation at first.

The city of Mexico was founded in the year 1325, in the most incommodious situation we can imagine, viz. on a small island named Tenochtitlan, in the middle of a great lake, without ground to cultivate for their subsistence, or even room sufficient to build their habitations. Their life was therefore as miserable here for some time as it had been when they were on the islands at the end of the lake, and they were reduced to the same shifts to maintain themselves. To enlarge the boundaries of their island, they drove palisades into those parts of the water which were most shallow, terracing them with stones and turf, and uniting to their principal island several other smaller ones which lay in the neighbourhood. To procure to themselves afterwards stones, wood, &c. for constructing their habitations, as well as clothing and other necessaries, they instituted a commerce with the people who dwelt on the borders of the lake, supplying them with fish, water-fowl, and other more minute inhabitants of the lake and marshes, which they contrived to render eatable; and in return, for all this they received the necessaries abovementioned. The greatest effort of their industry, however, was the construction of floating gardens, by means of bushes and mud of the lake; and these they brought to such perfection that they produced maize, pepper, chia, French beans, and gourds.

24 The two factions separate.

For thirteen years that the Mexicans had to struggle with extreme difficulty, they remained at peace; but no sooner did they begin to prosper and live comfortably, than the inveterate enmity betwixt the two factions formerly mentioned broke out in all its fury. This produced a separation; and one of the parties took up their residence on a small island at a little distance to the northward, which, from an heap of sand found there, they at first named *Xaltilolco*, but afterwards *Tlatelolco*, from a terrace constructed by themselves. This island was afterwards united to that of Tenochtitlan.

About this time the Mexicans divided their city into four parts, a division which still subsists; each quarter having now its tutelar saint, as it had formerly its tutelar god. In the midst of their city was the sanctuary of their great god *Mexitli*, whom they constantly preferred to all the rest. To him they daily performed acts of adoration: but instead of making any progress in humanity, they seem to have daily improved in the most horrible barbarities, at least in their religion. The dreadful sacrifices made of their prisoners already mentioned, could only be exceeded by that which we are now about to relate. Being now on a more respectable footing than formerly, they sent an embassay to the petty king of Colhuacan, requesting him to send them one of his daughters, that she might be consecrated the mother of their protecting god. The unsuspecting prince, intoxicated with the thoughts of having his daughter made a goddess, readily complied with their desire.—The unfortunate princess was conducted in great triumph to Mexico; but no sooner was she arrived, than she was sacrificed in the shocking manner above related; and, to add to the horror of the deed, the body was flayed, and one of the bravest young men of the nation dressed in her skin. Her father, ignorant of this dreadful transaction, was invited by the Mexicans to be present at the apotheosis of his daughter, and went to see the solemnity, and to worship the new divinity. He was led into the sanctuary, where the young man stood clothed in the bloody skin of his daughter; but the darkness of the place prevented him from seeing what was before him. They gave him a censor in his hand, and some copal to begin his worship; but having discovered by the flame of the copal the horrible spectacle, he ran out in a distracted manner, calling upon his people to revenge the injury; but this they were not able to do at that time nor ever after. Historians are unanimous, that this sacrifice was performed at the express command of the devil; and indeed in this instance, their credulity seems pardonable; though Clavigero, with more reason, ascribes it to his priests.

25 Monstrous barbarity of their religion.

In

Mexico.

In the year 1352 the Mexican government was changed from an aristocracy to a monarchy. At first they were governed by 20 lords, of whom one had an authority superior to the rest. This naturally suggested the idea of monarchy; and to this change they were also induced by the contemptible state in which their nation still continued, thinking that the royal dignity would confer upon it a degree of splendor which otherwise it could not enjoy; and that by having one leader, they would be better able to oppose their enemies. Proceeding, therefore, to elect a king, the choice fell upon Acamapitzin, a man of great estimation among them, and descended from Opochtli a noble Atzecan, and a princess of the royal family of Colhuacan. As he was yet a batchelor, they attempted to negociate a marriage, first with the daughter of the lord of Tacuba, and then of the king of Azcapozalco: but these proposals being rejected with disdain, they applied to Acolmiztli lord of Coatlichan, and a descendent of one of the three Acolhuan princes; who complied with their request, and the nuptials were celebrated with great rejoicings.

26 Acamapitzin the first king of Mexico.

27 The Tlatelolcos also choose a king.

In the meantime, the Tlatelolcos, the natural rivals of the Mexicans, resolved not to be behind them in any thing which had the least appearance of augmenting the glory of their state. They likewise, therefore, chose a king; but not thinking proper to choose him from among themselves, they applied to the king of the Tepanecas, who readily sent them his son; and he was crowned first king of Tlatelolco in 1353. In this the Tlatelolcos seem to have had a design of humbling their rivals, as well as rendering themselves more respectable; and therefore it is probable, that they had represented the Mexicans as wanting in that respect due to the Tepanecan monarch, as having elected a king without his leave, though at the same time they were tributaries to him. The consequence of this was, that he took a resolution to double their tribute. Hitherto they had paid only a certain number of fish and water-fowl; but now they were ordered to bring also several thousands of fir and willow plants to be set in the roads and gardens of Azcapozalco, and to transport to the court a great floating garden, which produced vegetables of every kind known in Anahuac. This being accomplished with great difficulty, the king commanded them next year to bring him another garden, with a duck and swan in it both sitting upon eggs; but so, that on their arrival at Azcapozalco the brood might be ready to hatch. This was also done; and the prince had the satisfaction of seeing the young birds come out of the eggs. The third year they were ordered to bring a live stag along with a garden. This was more difficult than any of the former tasks; because they were obliged, in order to hunt the stag, to go to the mountains of the continent, where they were in danger of falling into the hands of their enemies; however, this also was accomplished, and the desire of the king gratified.

28 Mexicans oppressed.

In this manner the Mexicans were oppressed for no less than 50 years. They freed themselves, however, from all their difficulties by vigorous exertions, absurdly ascribing to the protection of that malevolent being whom they worshiped the glory of every deliverance. Acamapitzin governed this city which at that time comprehended the whole of his dominions, for 37 years in peace. His queen being barren, he married another wife, but without abandoning the first; and these two, instead of being rivals to one another, lived together in the utmost harmony; the first wife taking upon herself the charge of educating *Huitzilihuitl*, the son of the second. He had, besides, several children by other women, and one named *Itzcoatl*, who afterwards proved one of the best and most renowned kings who sat on the throne of Mexico. He is said also to have conquered four considerable cities; but Clavigero thinks he must in this only have been an auxiliary, it being very improbable, that while he could scarce maintain his own territories, he should think of foreign conquests.

Acamapitzin died in 1389, greatly lamented by the Mexicans, and his death was followed by an interregnum of four months. As the deceased monarch had formerly resigned his authority into the hands of his nobles, it was necessary that a new election should take place; and when this was done, the choice fell upon Huitzilihuitl, the son of Acamapitzin. As he was still unmarried, it was resolved, if possible, to procure him an honourable and advantageous match. With this view, a deputation of nobility was sent to the king of Azcapozalco, requesting, in very humble terms, an alliance with one of his daughters. The expressions made use of by these ambassadors are said by our author to have been particularly elegant in the Mexican language: but it is difficult to understand how a speech made among a people ignorant of the art of writing could be particularly recorded at the interval of some hundreds of years after. They are as follow: "We beseech you, with the most profound respect, to take compassion on our master and your servant Huitzilihuitl, confined among the thick rushes of the lake.—He is without a wife, and we without a queen,—Vouchsafe, Sir, to part with one of your jewels or most precious feathers. Give us one of your daughters, who may come to reign over us in a country which belongs to you."

29 Huitzilihuitl the second king.

This piece of oratory had such an effect upon the king, that he granted their request, and a Tepanecan princess was conducted in great triumph to Mexico, where the marriage was solemnized with the utmost joy. Though this princess brought him a son the first year of their marriage, the king, in order to strengthen himself by fresh alliances, married also the daughter of another prince, by whom he had Montezuma *Ilhuacamina*, the most celebrated of all the Mexican kings.

30 Marries a daughter of the king of the Tepanecans.

We must now return to the history of the Acolhuans, who at this time were governed by Techotlala the son of Quimatzin. For 30 years this prince enjoyed an uninterrupted tranquillity. This was interrupted by the revolt of Tzompan, prince of Xaltocan, and the last of the family of Chiconquauhtli, one of the three original Acolhuan princes, who had drawn into his conspiracy the sovereigns of six other states. The king, out of respect to the quality of the rebel, offered to pardon him if he would lay down his arms; but Tzompan, confident of his strength, rejected the offer with contempt. The king was therefore obliged to send an army against him, in

31 Reign of Techotlala king of Acolhuan.

Mexico.

in which the Tepanecans and Mexicans served as auxiliaries. The war lasted only two months; Tzompan was defeated and put to death, along with several others of the principal rebels. The Mexicans, who had behaved with great valour, returned in triumph to their city, while Techotlala took several very prudent measures to strengthen his government, prevent rebellions in future, and to augment the splendor of his throne.

In consequence of the renown acquired in this war by the Mexicans, and the advantages resulting from the alliance with the king of Azcapozalco, that people now began to be held in much higher estimation by their neighbours than before. They extended their commerce, and in consequence of that, came to wear cotton instead of the threads of the wild-palm, which had formerly constituted their whole dress: but this gleam of prosperity was soon overcast, and they had to encounter a more inveterate and formidable enemy than any that they had yet met with. This was Maxtlaton prince of Coyoacan, and son to the king of Azcapozalco. Being of a cruel and revengeful temper, for which he was dreaded even by his father, he resolved to resent the indignity which he pretended to have been done to him by the marriage of his sister to the king of Mexico. The true cause of his displeasure, however, was his fear that the Tepanecan crown might devolve on his sister's son by Huitzilihuitl; and to prevent this, he took the barbarous method of sending assassins to murder his nephew. The king of Mexico was not then able to resent the injury; for though, by his marriage with the Tepanecan princess, the oppressive tribute was taken off, and the Mexicans had only to pay a couple of ducks annually, by way of acknowledging the Tepanecan superiority, yet the one nation was far from being in a condition to cope with the other.—The barbarity of Maxtlaton was not unknown to his father; but it is certain that he did not resent it; and indeed there is great reason to suppose that he took part with his son in most of his wicked enterprises.

32 Maxtlaton an inveterate enemy to the Mexicans.

As the Mexicans advanced in wealth and power, so did their rivals the inhabitants of Tlatlelolco.—Their first king died in 1399, leaving his subjects greatly improved in civilization, and the city much enlarged and beautified. The ivalship which subsisted between the two cities had indeed greatly contributed to the aggrandizement of both. The Mexicans had formed so many alliances by marriage with the neighbouring nations, had so much improved their agriculture, and floating gardens on the lake, and had built so many more vessels to supply their extended commerce and fishing, that they were enabled to celebrate their secular year, answering to A. D. 1402, with greater magnificence than they had ever done since they left their original country of Atzlan.

33 Unfortunate reign of Techotlala's son.

All this time Techotlala continued to reign in Acolhuacan; but being now very far advanced in years, and finding his end approach, he called to him his son Ixtlilxochitl, and recommended to him to beware of the ambitious disposition of the king of Azcapozalco, as he was apprehensive that he might attempt something against the peace of the empire. His suspicions were verified; for on the death of Techotlala, which happened in 1406, the king of Azcapozalco, without making the usual submissions to the new king, to whom he was a feudatory, set out for his own territories, with a view to stir up the other feudatory princes to rebellion. Having called to him the kings of Mexico and Tlatlelolco, he told them, that Techotlala, who had long tyrannized over that country, being dead, he designed to procure freedom to the princes, so that each might rule his own territory entirely independent of the king of Acolhuacan; but for this purpose he needed their assistance, and trusted to their well known spirit to take part with him in the enterprise. He informed them likewise, that in order to ensure success, he would find means to unite other princes in the confederacy.

The new king of Acolhuacan, in the mean time, was employed in settling the affairs of his kingdom, and endeavouring to gain the good will of his subjects. The combination against him was soon discovered: but though Ixtlilxochitl was desirous of heading his army in person, he was dissuaded from so doing by his courtiers; so that the conduct of the war was committed to his generals. To weaken the enemy they ravaged the territories of six revolted states: but notwithstanding this, and the superior discipline of the royal army, the war was carried on by the rebels with great obstinacy, their armies being constantly recruited by fresh troops in proportion to their losses. At last, after three years of a ruinous war the king of Azcapozalco, finding that his resources would at last fail him, sued for peace; but with a design of accomplishing by treachery what he had not yet been able to do by force. His adversary, equally reduced with himself, consented to a peace, though he knew very well that the Tepanecan prince intended to observe it no longer than suited his purpose.

34 Chimalpopoca third king of Mexico.

In the year 1406 died Huitzilihuitl king of Mexico, who likewise left the right of electing a successor to the nobility. They made choice of his brother Chimalpopoca; and from thence it became an established law to choose one of the brothers of the deceased king, or if he had no brothers to elect one of his grandsons. While the new prince was endeavouring to secure himself on the throne, the treacherous Tezozomoc used all means in his power to strengthen the party he had formed against the king of Acolhuacan. In this he was attended with such success, that the unfortunate prince found himself reduced to the necessity of wandering among the neighbouring mountains, at the head of a small army, accompanied by the lords of Huexolta and Coatlichan, who remained always faithful to him. The Tepanecans distressed him to such a degree, by intercepting his provisions, that he was forced to beg them of his enemies. One of his grandsons was sent to Otompan, a rebel state, to request them to supply their king with the provisions he stood in need of, and to exhort them to abandon the cause of the rebels, which they had espoused. No task could be more dangerous; yet such was the magnanimity of the young prince's disposition, that he readily set out on the journey; nor was he deterred by the information he got that there were in the place certain Tepanecans who had come on purpose to publish a proclamation from Tezozomoc. He went boldly to the most public place of the town, and in presence of those who

35 Distress and death of the king of Acolhuacan.

Mexico.

who publiſhed the proclamation made known his requeſt. This heroiſm, however, did not meet with the ſucceſs it deſerved. His propoſitions were derided from the moment they were made; but the people did not offer any farther inſult, until one of the meaner ſort threw a ſtone at him, exciting others of the ſame ſtamp to put him to death. The Tepanecans, who had hitherto continued ſilent, perceiving their opportunity, joined in the general cry to kill the prince, and began alſo to throw ſtones. The prince attempted firſt to defend himſelf, and afterwards to eſcape by flight; but, both being equally impoſſible, he fell under a ſhower of ſtones. The Tepanecans exulted in this act of treachery, and ſoon after cut off Ixtlixochitl himſelf, after having treacherouſly perſuaded him to a conference with two of their captains. This perfidious act was committed in ſight of the royal army, who were too weak to revenge it: the royal corpſe was ſaved with difficulty; and *Nezahualcojotl*, heir apparent to the crown, was obliged to ſhelter himſelf among the buſhes from the fury of his enemies.

36 Acolhuacan conquered by Tezozomoc.

Tezozomoc having now in a great meaſure gained his point, proceeded to pour down his troops upon thoſe cities and diſtricts which had remained faithful to the late unfortunate monarch. The people made a moſt deſperate defence, and killed vaſt numbers of their enemies; but at laſt being themſelves reduced by the calamities of war, and in danger of total extermination, they were obliged to quit their habitations and fly to other countries. The tyrant, then finding himſelf ſuperior to all his adverſaries, gave Tezcuco in fief to Chimalpopoca king of Mexico, Huexotla to Tlacacotl king of Tlatelolco; placing faithful governors in other places, and appointing Azcapozalco, the capital of his own territory, the royal reſidence and capital of Acolhuacan.

Prince Nezahualcajotl was preſent in diſguiſe at this diſpoſal of his dominions, along with ſeveral other perſons of diſtinction who were enemies of the tyrant; and ſo much was he tranſported with paſſion, that it was with difficulty he could be reſtrained from killing Tezozomoc on the ſpot, though this would certainly have been done at the expence of his own life. All the reſt of the Acolhuacan empire ſubmitted; and Nezahualcojotl ſaw himſelf for the preſent deprived of all hopes of obtaining the crown.

37 His tyranny and death.

Tezozomoc had now attained the ſummit of his ambition: but inſtead of conciliating the minds of his new ſubjects, oppreſſed them with new taxes; and being conſcious of the precarious ſituation in which he ſtood, and tormented with remorſe on account of his crimes, fell into melancholy, and was haunted with frightful dreams. In one, he imagined that Nezahualcojotl, transformed into an eagle, had eat out his heart; and in another, that, in the ſhape of a lion, he licked his body and ſucked his blood. Terrified by theſe viſions, he called his three ſons, Tajatzin, Teuctzintli, and Maxtlaton, enjoining them to put to death Nezahualcojotl as ſoon as they could get it done without being publicly known. He himſelf ſurvived his dreams only about a year. He was now become ſo old, that his body no longer retained its natural heat. He was therefore obliged to be covered up with cotton in a great cradle, not being able to ſit erect in a chair. In this miſerable condition, however, he never forgot his tyranny nor cruelty. From his cradle he iſſued oppreſſive laws relating to the Acolhuacans; and almost with his laſt breath renewed his commands with regard to Nezahualcojotl. At laſt he expired in the year 1422, leaving the crown to his ſon Tajatzin.

38 The throne uſurped by Maxtlaton.

Tezozomoc was no ſooner dead than Maxtlaton, without paying the leaſt regard to his father's will, began to exerciſe the functions of a ſovereign. Though it was the right of Tajatzin to invite to his father's funeral whom he pleaſed, Maxtlaton took that upon himſelf. Nezahualcojotl, though not invited, came among the reſt; but though Teuctzintli, brother to Maxtlaton, inſiſted upon his being put to death, the latter oppoſed it, as it could not then be done privately, and he hoped to find another opportunity. No ſooner were the funeral ceremonies over, however, than Maxtlaton behaved in ſuch a manner to his brother Tajatzin, that the prince thought proper to retire to Chimilpopoca king of Mexico, to whom he had been particularly recommended by his father, in order to have his advice. This monarch, agreeable to the character of that age and people, adviſed him to invite his brother to an entertainment, and then murder him. Unluckily for them both, this diſcourſe was overheard by a ſervant, who in expectation of a reward informed the tyrant of what he had heard: but inſtead of this, Maxtlaton, pretending to diſbelieve his ſtory, drove the informer from his preſence with ignominy. Notwithſtanding this pretence, the tyrant had not the leaſt doubt of the truth of what was told him; and therefore determined to rid himſelf of his brother without delay. This he ſoon accompliſhed in the very ſame way that had been projected againſt himſelf. Tajatzin, along with the king of Mexico, Tlatelolco, and ſome other feudatory princes, were invited by Maxtlaton to an entertainment. The king of Mexico prudently excuſed himſelf, but the unſuſpecting Tajatzin fell into the ſnare. He came to the place of entertainment, and was inſtantly put to death. The company were greatly alarmed; but Maxtlaton, having explained to them his reaſon for ſo doing, they not only excuſed him, but proclaimed him king; to which it is not to be doubted that their fears greatly contributed.

39 Tajatzin murdered.

Though the king of Mexico eſcaped a ſudden death by his abſence at this time, it was only to periſh in a more ſlow and ignominious manner. The vengeance of Maxtlaton firſt appeared by ſending him a woman's dreſs in return to the preſent he ſent him as a feudatory; which being a reflection upon his courage, was the higheſt affront that could be offered him. This inſult, however, was quickly followed by one of a much higher nature. Having heard that one of the Mexican prince's wives was an extraordinary beauty, he enjoined ſome Tepanecan ladies, who were accuſtomed to viſit that princeſs, to invite her to ſpend ſome days with them at Azcapozalco. This being complied with, the tyrant eaſily got an opportunity of raviſhing her, and then ſent her back to her huſband. Chimilpopoca was ſo much affected by this misfortune, that he reſolved to offer himſelf up a ſacrifice to his god. Maxtlaton, however, was reſolved that

40 Miſerable fate of the king of Mexico.

Mexico.

that he ſhould not have even this ſatisfaction. At the very time of the ceremony therefore he ſent a body of troops; who entering Mexico without reſiſtance, carried off the king alive, to the aſtoniſhment of the multitude; and who probably were ſo much confounded by this unexpected adventure, that they did not think of making any reſiſtance.

Chimilpopoca being carried priſoner to Azcapozalco, was confined in a ſtrong wooden cage, the common priſon for criminals. Maxtlaton ſtill was not ſatisfied: he wiſhed to get into his hands Nezahualcajotl; and with this view ſent a meſſage to him, pretending that he was willing to come to an agreement with him reſpecting the kingdom of Acolhuacan. Though the prince was well aſſured of the tyrant's treacherous intentions, he went boldly to his palace, preſented himſelf before him, and told him that he had heard of the impriſonment of the king of Mexico, he had heard alſo that he wiſhed to take away his own life; he deſired him to do ſo, and to gratify his malice. Maxtlaton was ſo ſtruck with this ſpeech, that he aſſured the prince he had not formed any deſign againſt his life; and that he neither had put to death the king of Mexico, nor would do ſo. He then gave orders for his being properly entertained, and even allowed him to pay a viſit to the king of Mexico in priſon. The unfortunate Chimilpopoca, after reciting his misfortunes, requeſted the prince not to return to court, where they would certainly fall upon ſome project for taking away his life: and having pathetically recommended to him the care of his ſubjects, made him a preſent of a gold pendant and ſome other jewels he wore; after which they took a laſt farewell.

41 He is viſited in priſon by Nazahualcajotl.

Chimilpopoca languiſhed in priſon for ſome little time after the departure of Nezahualcajotl; but life became at laſt ſo intolerable to him, that he hanged himſelf in his girdle. His voluntary death, in ſpite of all that the tyrant had done to prevent it, ſo exaſperated the latter, that he reſolved upon the death of the prince at all events, whether in the way recommended by his father or not; to which it is not improbable that he was likewiſe inſtigated to this by certain predictions of the prieſts. He ſent out four captains, therefore, with a ſmall party of troops, in queſt of the fugitive prince, with orders to kill him as ſoon as they overtook him. Theſe meſſengers of death ſet out directly for Tezcuco, where the prince happened to be at that time playing at foot-ball; for he ſpent great part of his time in ſuch diverſions, that he might remove all ſuſpicions of his aſpiring to the throne; and thus he had an opportunity of carrying on his negociations without moleſtation. As he knew the errand on which the Tepanecan captains came, he left off his play on their appearance, and retired to his inner apartment. On being informed that they inquired for him, he ſent for anſwer that he would wait upon them after they had repoſed and refreſhed themſelves. The prince made uſe of this opportunity to quit the houſe, and retire by a ſecret door; or, according to Torquemada, by a kind of labyrinth which he had conſtructed, and through which none but himſelf knew the way. He then fled to Coatlichan, a ſmall ſettlement of weavers, who were all exceedingly attached to him. He was purſued thither by the aſſaſſins, who had been informed by a countryman of the road he had taken; but ſuch was the inviolable fidelity of the inhabitants, that ſeveral of them ſuffered themſelves to be put to death rather than diſcover the place of his concealment. Leaving this place, therefore, they went thro' the country in queſt of him; and no ſooner were they gone, than the prince ſet out in a way directly contrary to that which they had taken. Being purſued in all directions, however, he was in the utmoſt danger, and would once have been made priſoner if ſome countrymen had not concealed him under an heap of chia. Having eſcaped this danger, he went to a pleaſant villa at Tezcotzinco, belonging to his anceſtors; where he was met by ſix lords who had left their ſtates. Having conſulted with them, it was determined to apply to the Chalceſe, although they knew that they were an unfaithful and treacherous people, and had been concerned in the death of the late king. He was then met by ambaſſadors from the Cholulans, who offered him their aſſiſtance againſt the uſurper. In a ſhort time he was joined by numbers of others; ſo that he was not only no longer in danger of his life, but began to be formidable to his enemies.

42 Adventures of that prince.

In the mean time, the Mexicans, who had ſuffered many injuries ſince the death of Chimilpopoca, raiſed to the throne Itzcoatl, the ſon of Acamapitzin, by a ſlave, and who was accounted the moſt prudent, juſt, and brave, of all the Mexican nation. His election was no leſs pleaſing to Nezahualcajotl and his party, than it was offenſive to Maxtlaton. An alliance was quickly concluded between the exiled prince and the king of Mexico; and this was ſoon followed by the commencement of hoſtilities on the part of the former. His firſt enterpriſe was againſt the city of Tezcuco, which he determined to take by aſſault, but was prevented by the ſubmiſſion of the inhabitants. He put to death, however, all the officers eſtabliſhed by the tyrant: and all the Tepanecans he found there. The very ſame day another large city named Acolman was furiouſly attacked by a detachment of his army; great numbers put to the ſword, and among the reſt the governor, who was brother to Maxtlaton; and the ſame day alſo Coatlichan was taken by the Chalceſe.

43 Itzcoatl raiſed to the throne of Mexico, who aſſiſts Nezahualcajotl.

The Mexican monarch, hearing of the ſucceſſes of his ally, ſent an embaſſy to congratulate him upon them. His ambaſſador was a ſon of king Huitzilihuitl, named *Montezuma*, who for his invincible courage and great qualities was ſurnamed the *man of great heart and the archer of heaven*. The journey was extremely dangerous; but Montezuma undertook it without any fear, accompanied by another nobleman. They got in ſafety to the place where the prince was; but had the misfortune to be taken priſoners, and were carried to Chalco; the lord of which city, named Toteotzin, was an inveterate enemy to the Mexicans. By him he was immediately put in cloſe confinement, under the care of one Quateozin, who was inviolably attached to the Mexican intereſt. Orders were given to the latter to provide no ſuſtenance for the priſoners but what was preſcribed by his lord, until the mode of death which they were to ſuffer ſhould be determined. Toteotzin then, with a view to flatter the Huexotzincas, ſent his priſoners to them, that they might be ſacrificed there if they thought proper. Theſe people, however, rejected the propoſal with diſdain; on which Toteotzin,

44 Dangerous embaſſy undertaken by Montezuma.

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zin, thinking to regain the favour of Maxtlaton, notwithstanding his treachery in abandoning his cause, informed him of the prisoners he had in his possession. But Maxtlaton (whose character seems not to deserve all the reproaches with which it is loaded) called him a double-minded traitor, and commanded him instantly to set the prisoners at liberty. Before this answer arrived, however, Quateozin had instructed the prisoners how to make their escape, and directed them also not to return by land lest they should again be intercepted, but to embark at a certain place, and proceed by water to Mexico. They followed his advice exactly; and having got to the place to which they were directed, arrived safely at their city, to the great surprise and joy of the inhabitants.

Toteotzin, enraged at the loss of his prisoners, put Quateozin to a cruel death, destroying also all his family excepting one son and daughter; of whom the latter fled to Mexico, where she was highly honoured on her father's account. Maxtlaton, too, notwithstanding his generosity to the prisoners (which Clavigero derives from mere opposition to Toteotzin), prepared to wage a formidable war with the Mexicans, who had agreed to unite their troops with those of the prince. The Mexican populace, terrified at engaging so powerful an enemy, demanded that their king should submit and beg for peace. So great was the tumult, that the king himself was obliged to consent; and it required the utmost exertions of Montezuma's eloquence to persuade the people to agree to a commencement of hostilities. This being done at last, the king next called together the chief nobility, and asked which of them would have the courage to carry an embassy to the king of the Tepanecans? This adventure appeared so hazardous, that all of them kept a deep silence until Montezuma declared himself willing to undertake the arduous enterprise. He was ordered to propose peace to Maxtlaton, but to accept of no dishonourable conditions; to which he punctually adhered. Maxtlaton refused to give any immediate answer, but promised to give one next day, after he had consulted his nobility. Montezuma, dreading some treachery if he staid all night, promised to return next day; which he did, and was told that Maxtlaton had determined upon war. Montezuma then performed the ceremony of challenging him, by presenting him with certain defensive weapons, anointing his head, and fixing feathers upon it, as was customary to do with dead persons. Lastly, he protested, in the name of his master, that as Maxtlaton would not accept of the offered peace, he and all the Tepanecans would infallibly be ruined. Maxtlaton showed not the least sign of displeasure, but gave Montezuma arms in like manner to present to the king of Mexico; and directed him, for his personal security, to return in disguise through a small outlet from the palace. Montezuma followed his advice; but as soon as he found himself out of danger, began to insult the Tepanecan guards; and though they rushed violently upon him, he not only escaped from their attacks, but killed one or two of them.

45 Maxtlaton declares war against Mexico.

On his return to Mexico, the populace were again thrown into the utmost consternation by the news that war was inevitable, as the chiefs of the two nations had challenged one another. They now requested the king to allow them to retire from their city, of which they supposed the ruin to be certain. The king encouraged them with the hopes of victory. "But if we are conquered (replied they), what will become of us?" "If that happens (answered the king), we are that moment bound to deliver ourselves into your hands, to be made sacrifices at your pleasure." "Be it so (replied they), if we are conquered; but if we obtain the victory, we and our descendents are bound to be tributary to you; to cultivate your lands and those of your nobles; to build your houses; and to carry for you, when you go to war, your arms and baggage."

Matters being thus settled, intelligence was sent to prince Nezahualcajotl to repair with his army to Mexico, which he did without delay; and the day after his arrival a furious engagement took place. The Tepanecan army was commanded by a general named *Mazatl;* Maxtlaton himself not judging it proper to quit his capital. The soldiers on both sides fought with the utmost bravery; but towards night the Mexicans, disheartened by seeing the army of their enemies continually increasing in number, began once more to lose their courage and talk of surrendering. The king, greatly concerned, asked Montezuma what should be done to dissipate the fears of the people? That brave prince replied, that they must fight till death; that if they died with their arms in their hands, it would be honourable; but to survive their defeat, would be eternal ignominy. Nothing could be more salutary than this advice at so critical a juncture: for the Mexicans were already begun to implore the mercy of their enemies, and to promise to sacrifice their chiefs, whose ambition had brought the whole nation into such a dilemma. On hearing this, the whole body of nobility, with the king and Montezuma at their head, assaulted the enemy so furiously, that they repulsed them from a ditch of which they had taken possession; after which, Montezuma, happening to encounter Mazatl the Tepanecan general, struck him such a blow on the head that he fell down lifeless. Thus the Mexicans were inspired with fresh courage, and their enemies proportionally dispirited: however, they retired for that night to the city, in some hopes of being able to retrieve their fortune next day. Maxtlaton encouraged them by every method in his power; but fortune proved still more unfavourable than the day before. The Tepanecans were now entirely defeated, and the city of Azcapozalco taken. Maxtlaton, who seems not to have had the courage to fight, had not now the presence of mind to fly. He attempted indeed to hide himself; but being quickly discovered, he was beaten to death with sticks and stones. The city was plundered, the inhabitants butchered, and the houses destroyed by the victors.

46 He is defeated and killed.

This victory proved decisive in favour of the confederates. Every other place of strength in the country was quickly reduced, until the Tepanecans, finding themselves on the verge of destruction, sent an humble embassy to the king of Mexico, requesting to be taken under his protection, and to become tributaries to him. Itzcoatl received them graciously; but threatened them with total extirpation if they violated the fidelity they had sworn to him. Thus the whole Tepanecan nation was subjected to the Mexicans, excepting

47 The Tepanecans entirely reduced.

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cepting only the ſtate and city of Cojohuacan, which continued refractory for a conſiderable time.

Itzcoatl, after this extraordinary ſucceſs, took care to have the abovementioned contract ratified between the nobility and common people, by which the latter were bound to perpetual ſervices. Thoſe who had diſcouraged the ſoldiers in time of battle were baniſhed for ever from the ſtate of Mexico; while Montezuma and others who had diſtinguiſhed themſelves by their bravery, were rewarded with lands, as was uſual with other conquerors.

48 Nexahualcajotl made king of Acolhuacan.

Itzcoatl, now finding himſelf firmly ſeated on the throne of Mexico, ſet about performing his engagements to the Acolhuacan prince, by ſeating him on the throne of his anceſtors. Having again joined their armies, they marched againſt Huaxotla, a city which refuſed to ſubmit even though terms of pardon were offered them. Inſtead of this, they raſhly ventured a battle, in which they were entirely defeated; and were then fain to ſend a deputation of their old men, pregnant women, &c. as was cuſtomary in caſes of diſtreſs, to move the enemy to compaſſion. At laſt all obſtacles being removed, Nezahualcajotl was ſeated on the throne of Acolhuacan, the auxiliary troops were diſmiſſed, and Itzcoatl left at liberty to purſue his conqueſts, in which he was ſtill aſſiſted by the king of Acolhuacan. The firſt expedition was againſt Cojohuacan and other two Tepanecan cities, who had not only refuſed ſubmiſſion themſelves, but excited others to ſhake off the yoke alſo. The war againſt them proved bloody. Three battles were fought, in which Itzcoatl gained no other advantage than making the enemy retreat a little; but in the fourth, while the two armies were hotly engaged, Montezuma, with a body of choſen troops, which he had placed in ambuſcade, attacked the rear-guard of the rebels with ſuch vigour, that they were ſoon diſordered, and obliged to fly to the city. The conquerors purſued them thither; and Montezuma perceiving that they intended to fortify themſelves in the greater temple, fruſtrated their deſign by getting poſſeſſion of it and burning the turret. By this diſaſter they were ſo much terrified, that they fled to the mountains ſouth of Cojohuacan; but even there the royal army overtook and purſued them more than 30 miles, till they came to another mountain, where, quite exhauſted with fatigue, and ſeeing no means of eſcape, they were obliged to ſurrender at diſcretion.

49 Conqueſts of the Mexicans.

Having thus happily accompliſhed the conqueſt of Cojohuacan and the other rebellious cities, the two kings returned to Mexico. Itzcoatl gave great part of the Tepanecan country to *Totoquihuatzin*, with the title of king of *Tacuba*, a grandſon of Tezozomoc, but who does not appear to have been any way concerned in his projects againſt the Mexicans. An alliance was then formed among the three kings on the following terms: The king of Tacuba held his crown on condition of ſerving the king of Mexico with all his troops, at any time when required; for which he was to have a fifth part of the ſpoils taken from the enemy. The king of Acolhuacan was likewiſe to aſſiſt the king of Mexico in war; and for this he was to have a third part of the plunder, after deducting the ſhare of the king of Tacuba; and the remainder was to belong to the king of Mexico. The kings of Tacuba and Acolhuacan were both declared honorary electors of the kings of Mexico; the real electors being four nobles: and the king of Mexico was likewiſe bound to aſſiſt in the wars of his allies whenever it was demanded.

50 Alliance between the kings of Mexico, Acolhuacan, and Tepaneca.

After having thus ſettled matters among themſelves, and rewarding their ſoldiers, Itzcoatl ſet out with Nezahualcajotl for Tezcuco, where the Acolhuacan king was crowned with all poſſible ceremony. Here the new king took every method which prudence could ſuggeſt to eſtabliſh his authority on a permanent baſis; but while he was thus employed, the Xochimilcas, fearing leſt the Mexicans might conquer their country as they had done that of the Tepanecans, held a council on what was to be done to prevent ſuch a diſgrace. In this council it was determined to commence hoſtilities againſt that riſing ſtate, before it ſhould become more formidable by new conqueſts. Itzcoatl was no ſooner informed of this determination, than he ſent Montezuma with a great army againſt them. The Xochimilcas met him with one ſtill more numerous; but being worſe diſciplined, they were quickly defeated, and their city taken in a very ſhort time after. This conqueſt was followed by the reduction of Cuitlahuac, ſituated on a ſmall iſland on the lake of Chalco. Their inſular ſituation gave them confidence to attack the formidable power of the Mexicans. The king was ſo ſenſible of the difficulty of this enterpriſe, that he propoſed to attack them with the whole force of the alliance: Montezuma, however, with only a ſmall number of men of his own training, whom he furniſhed with proper veſſels, reduced them in ſeven days.

51 Other conqueſts.

Theſe conqueſts were followed by the reduction of the cities of Quauhnahuac, Quantitlan, and Toltitlan; the firſt of which was ſo ſtrong, that Itzcoatl was obliged to call in his allies to his aſſiſtance. In ſhort, in the ſpace of twelve years, Mexico, from being a contemptible and tributary ſtate, became able to command thoſe whom it had formerly ſerved, and who thought themſelves very much ſuperior in every reſpect.

52 Montezuma I. king of Mexico.

Itzcoatl died in the year 1436, at a very advanced age, in the height of proſperity, and was ſucceeded by Montezuma I. the greateſt monarch that ever ſat on the Mexican throne. Before his coronation, in order to comply with the barbarous rites of his religion, he made war upon the Chalceſe in order to procure the priſoners who were to be ſacrificed at his coronation; and ſcarce was this ceremony over, than a new war commenced, which terminated in the deſtruction of that city. This quarrel happened between the Chalceſe and the Tezcucans. Two of the royal princes of Tezcuco having gone a-hunting on the mountains which overlook the plains of Chalco, while employed in the chace, and ſeparated from their retinue, with only three Mexican lords, fell in with a troop of Chalceſe ſoldiers; who, to gratify the cruelty of their maſter, carried them all priſoners to Chalco. The cruel and inconſiderate tyrant who commanded there inſtantly put them all to death; after which he cauſed their bodies to be ſalted, dried, and placed in an hall of his palace, where they ſerved as ſupporters to the pine torches burned there for light every evening. The king of Texcuco, overwhelmed

with

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with grief, and to the last degree exasperated at such an inhuman act, called for the assistance of the allied kings. The city was attacked at once by land and water. The inhabitants, knowing that they had no mercy to expect, fought like men in despair. Even the old tyrant who commanded them, though unable to walk, caused himself to be carried in a litter among the combatants; notwithstanding which they were totally defeated, and the most severe vengeance executed upon them.

53 Chalco taken.

Montezuma, on his return found himself obliged to encounter an enemy more formidable on account of his vicinity than more powerful ones at a distance. This was the king of Tlatelolco, who had formerly conspired against the life of Itzcoatl; and finding himself disappointed in this had tried to reduce his power by entering into a confederacy with some of the neighbouring lords. At that time his designs proved abortive, but he resumed them in the time of Montezuma; the consequence of which was, that he was defeated and killed. One *Moquihuix* was chosen in his room; in whose election it is probable that Montezuma had a considerable share. This was followed by conquests of a much more important nature. The province of *Cuihixcas*, lying to the southward, was added to his dominions, comprehending a tract of country more than 150 miles in breadth; then, turning to the westward, he conquered another named *Tzompahacuan*. This success, however, was for a short time interrupted by a war with Atonaltzin, lord of a territory in the country of the Mixtacas. This prince, puffed up on account of the great wealth he possessed, took it into his head that he would allow no Mexican to travel through his country. Montezuma sent ambassadors to know the reason of such strange conduct; but Atonaltzin gave them no other answer than showing them some part of his wealth, making a present to the king, and desiring him from thence to observe how much the subjects of Atonaltzin loved him; and that he willingly accepted of war which was to determine whether he should pay tribute to the Mexicans or the Mexicans to him. Montezuma having informed his allies of this insolent answer, sent a considerable army against Atonaltzin, but had the mortification to be informed of its defeat; in consequence of which the pride of Atonaltzin was increased to a great degree. Montezuma, greatly chagrined at this first check, determined to head his next army in person; but before he could call together another, Atonaltzin had drawn into a confederacy with him the Huexotzincas and Tlascalans, who were glad of the opportunity, as they supposed, of reducing the power of the Mexicans. Their numbers however, availed but little; Montezuma in the very first engagement totally defeated the confederate army. The allies of Atonaltzin were particularly unfortunate; for such of them as were not killed in the field of battle, were destroyed by their own party out of revenge for the unfortunate event of the battle.

54 Tlatelolco reduced, and Moquihuix made king.

55 Atonaltzin defeated, and the Mexican dominions enlarged.

By this victory the Mexican monarch became master not only of the dominions of Atonaltzin, but of many other neighbouring princes, against whom he made war on account of their having put to death some Mexican merchants or couriers without any just cause. The conquest of *Cuetlachtlan* or *Cotasta*, however, which he attempted in 1457, proved a much more difficult task. This province lies on the coast of the Mexican gulph, and had been formerly inhabited by the Olmecans, whom the Tlascalans had driven out. The inhabitants were very numerous; but dreading the power of Montezuma, called in those of Tlascala, together with the Huexotzincas, to their assistance. Along with these the allies drew the Cholulans also into the confederacy; so that this appears to have been the most formidable combination that had yet been formed against the Mexican power. Montezuma collected an excellently equipped army; which, however, he did not on this occasion command in person. It contained a great number of persons of very high rank, among whom were three princes of royal blood, and *Moquihuix* king of Tlatelolco already mentioned. The combination of the three republics against Mexico was not known at court when the army set out; but Montezuma, being informed of it soon after, sent an order to his generals to return. This accorded so ill with the romantic notions of valour entertained by the Mexicans, that a consultation of the generals was held whether they should obey it or not. At last it was determined that the king's order should be obeyed; but no sooner was this agreed to than Moquihuix accused them all of cowardice, and threatened, with his own troops, unassisted, to go and conquer the enemy. His speech had such an effect upon them all, that they went to meet the confederates. The Cotastese fought with great valour, but were unable to resist the royal forces; and their allies were almost totally destroyed. Six thousand two hundred of them were taken prisoners, and soon after sacrificed to the Mexican god of war in the barbarous manner already described. The victory was said to have been owing principally to the valour and good conduct of Moquihuix, insomuch that to this day a song made in his praise on that occasion is known in Mexico. Montezuma was so well pleased with the victory, that he not only forgave the disobedience of his orders, but bestowed upon Moquihuix a princess, one of his own cousins, to wife.

56 Chalcese rebel, and are destroyed.

The next exploit of this great warrior was the entire destruction of the Chalcese, whose restless disposition continually brought mischief upon themselves. They had, it seems, formed a design of making their city a rival to Mexico; and with this view had taken prisoner one of the brothers of Montezuma himself, whom they attempted to make their sovereign absolutely against his own inclination. The prince, finding it impossible to resist, pretended to comply with their wishes; but that the act of exalting him to this dignity might be more conspicuous, he desired them to plant in the market place one of the highest trees, and place a scaffold upon it, from whence every body might see him. This being done, the Mexicans who had been taken along with him assembled round the tree; and the prince having ascended the scaffold with a bunch of flowers in his hand, addressed them to the following purpose: "Ye know well, my brave Mexicans, that the Chalcese wish to make me their king; but it is not agreeable to our god that I should betray our native country; I choose rather to teach you, by my example, to place higher value on fidelity to it

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it than on life itself." With these words he threw himself from the scaffold, and was killed. The Chalcese were so enraged at this, that they instantly fell upon the Mexicans and killed them with their darts. Next evening they were terrified by a screech owl; the dismal voice of which animal they interpreted into an omen of their approaching ruin. They were not deceived in their predictions, which indeed they might have made without any screech-owl. They were quickly attacked by Montezuma; who on this occasion was so much exasperated, that he caused fires to be lighted on the tops of the adjacent mountains, as symbols of the punishment to which he condemned the rebels. The havock he made among them was such, that the province was almost depopulated. Vast numbers were slaughtered, while those who escaped with life fled into the caves of the neighbouring mountains. Some fled into distant countries, leaving their city to be destroyed by the enemy. At last Montezuma, satiated with revenge, proclaimed a general pardon, and invited the fugitives to return; but many of them, not putting any confidence in his sincerity, chose to remain in their state of exile. The remainder of this emperor's reign was taken up in making new conquests; so that by the time of his death, which happened in 1464, he had extended his dominions as far as the gulf of Mexico on the east; to the middle of the country of the Mixtecas on the south-east; something farther than Chilapan on the south; to the valley of Toluca on the west; the centre of the country of the Otomies on the north-west; and, on the north, to the extremity of the vale of Mexico.

57 Inundation and famine at Mexico.

During the reign of this great monarch a violent inundation happened in Mexico. The lake, swelled by the excessive rains which fell in the year 1446, poured its waters into the city with so much violence that many houses were destroyed, and the streets inundated to such a degree that boats were every where made use of. To prevent accidents of this kind for the future, Montezuma, by the advice of the king of Tezcuco, constructed a great dyke nine miles in length, eleven cubits in breadth, and consisting of two parallel lines of pallisades, the interval betwixt which was filled up with stones and sand. The greatest difficulty in the construction lay in being obliged occasionally to work in the lake itself, which in some places was of considerable depth; but this was surmounted by the skill and perseverance of the workmen. The dyke, when constructed, proved of great service in keeping out the waters, though it did not entirely remedy the evil; nor indeed have the Spaniards been able to secure this city effectually from inundations, after being in possession of it for more than two centuries.

The inundation was soon followed by a famine. This was occasioned by the stinting of the crop of maize in 1448; the ears while young and tender being destroyed by frost. In 1450 the crop was totally lost for want of water; and in 1451, besides the unfavourable seasons, there was a scarcity of seed. Hence, in 1452, the necessities of the people became so great, that they were obliged to sell themselves for slaves in order to procure subsistence. Montezuma permitted them to go to other countries for support; but being informed that many sold themselves for a few days provision, he ordered by proclamation, that no woman should sell herself for less than 400 ears of wheat, nor any man for less than 500. He opened also the public granaries for the relief of the lower classes; but nothing was able to stop the progress of the famine. Many who went for relief to other countries perished with hunger on their journey; and great numbers who sold themselves for slaves never returned to their native country. Most of the populace supported themselves, like their ancestors, on the produce of the lake, until all their distresses were relieved by a most plentiful harvest in the year 1454.

58 Axayacatl succeeds Montezuma.

Montezuma was succeeded by Axayacatl, who like his predecessor instantly commenced a war, for no other reason than that he might have prisoners to sacrifice at his coronation. The people whom he now attacked inhabited the province of *Tecuantepec* on the coast of the Pacific Ocean, and situated at 400 miles distance from the city of Mexico. A very desperate battle ensued on this occasion, in which, however, the Mexicans at last prevailed; and, besides the poor wretches doomed to destruction whom they carried off, acquired a considerable spoil, as well as a tract of territory extending to Coatulco, a maritime place much frequented in the next century by the Spaniards.

59 His conquests.

Axayacatl pursued Montezuma's plan of conquest; in which, however, he was less successful, many of the provinces reduced by that monarch having revolted after his death, so that it was necessary to reconquer them. On his returning successful from one of these expeditions, he built a new temple, to which he gave the name of *Coatlon*; but the Tlatelolcos, whose ancient rivalship seems to have revived on the death of Montezuma, built another in opposition, which they called *Coaxolotl*. Thus the former hatred between the two nations was renewed, and a discord took place which ended in the ruin of the Tlatelolcos.

60 Death of the kings of Acolhuacan and Tacuba.

The Mexicans sustained an irreparable loss in 1469 and 1470 by the death of their allies the kings of Tacuba and Acolhuacan; for though the league which had been concluded between the three nations continued without any violation till the arrival of the Spaniards, we cannot suppose that any of the successors of the Tacuban and Acolhuacan princes would have the same cordial affection for those of Mexico which was entertained by those who lay under such great obligations to Montezuma. The king of Tacuba was succeeded by his son Chimalpopoca, and the Acolhuan monarch by his son Nezahualpilli. A short time after the accession of the latter, the war broke out between the Tlatelolcos and Mexicans, which ended in the destruction of the former. King Moquihuix had been married by Montezuma to a sister of Axayacatl, now on the throne of Mexico; but it appears that this princess never was greatly the object of his affection. On the contrary, he took all methods of expressing his dislike, either out of enmity to herself, or envy of the superior greatness of her brother. Not content with this, he entered into an alliance with a great number of the neighbouring states, in order to reduce the Mexican greatness. His wife, however, being informed of this scheme, communicated the particulars to her brother; and soon after, being impatient of the ill usage she received, came to Mexico with her four sons to claim the protection of her brother. This uncommon

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61 Tlatelolco reduced and the king killed.

uncommon accident exasperated the Mexicans and Tlatelolcans against each other to such a degree, that wherever they met, they fought, abused, and murdered each other. The king of Tlatelolco prepared for war with many horrid ceremonies, of which the drinking of human blood was one. A day was appointed for attacking Mexico. Xiloman, lord of Colhuacan, was to begin the attack, afterwards to pretend flight, in order to induce the Mexicans to follow him; after which the Tlatelolcos were to fall upon their rear. For some reason, however, with which we are not acquainted, the Tlatelolcos began the attack without waiting for Xiloman; the consequence of which was, that he retired in disgust, leaving them to finish their battle the best way they could. The engagement lasted till night, when the Tlatelolcos were obliged to retire. Axayacatl, during the night, disposed of his troops in all the roads which led to Tlatelolco, appointing them to meet in the market-place. The Tlatelolcos, finding themselves attacked on all sides, retired gradually before the Mexicans, until at last they were forced into the market-place, where they found themselves worse than ever on account of its narrowness, which did not allow them room to act. The king stood on the top of the great temple, encouraging his men to exert themselves against the enemy. His words, however, had now lost their usual influence. He not only was not obeyed, but was reproached with cowardice because he did not come down and fight among the rest. At last the Mexicans arrived at the temple, and ascended to the balcony where the king was. He made a desperate defence for a little; but by a violent push in the breast was thrown backward upon the steps of the temple, and stunned or perhaps killed by the fall. The soldiers took him up and carried him to Axayacatl; who with his own hand cut open his breast and tore out his heart. His people then attempted to fly across the market-place: but a great number of them were killed, among whom were many officers of distinction. The city of Tlatelolco was then united with Mexico, as a part or kind of suburb, which it still continues to be.

62 Axayacatl wounded and in great danger.

The Tlatelolcos being thus reduced, Axayacatl next set out on an expedition against the Matlatzincas, a tribe in the vale of Toluca, who still refused to submit to the Mexican yoke. Having proved successful in this expedition, he undertook to subdue also the northern part of the valley, now called *Valley d' Ixtlahuacan*, particularly *Xiquipilco*, a considerable city and state of the Otomies, whose chief was much renowned for strength and bravery. Axayacatl, who likewise valued himself on these qualities, encountered him in single combat. In this, however, he was over-matched, and received a violent wound on the thigh; after which he would have been taken prisoner, had not some young Mexicans made a desperate effort for his rescue. Notwithstanding this disaster, Axayacatl's army gained a complete victory, carrying off 11060 prisoners, among whom was the chief of the Otomies himself, and two of his officers who had attacked the king. These chiefs were put to death at an entertainment of the allied kings, the sight of their agonies not interrupting in the least the mirth of the feast; so much were they familiarized to the shedding of human blood.

63 Is succeeded by Tizoc.

Axayacatl continued to extend his territories to the east and west, till his progress was stopped by death in 1477. He was succeeded by his elder brother Tizoc; of whose reign we know little, but that he conquered fourteen cities, some of which had been in rebellion. He intended to have built a larger temple than any that had yet been seen in Mexico, though that originally built had been greatly enlarged by some of his predecessors. For this purpose he collected a great quantity of materials; but before he could bring his projects to bear, he was taken off by a conspiracy of his subjects. We are not informed in what manner he died; most probably it was by poison, as the conspirators wished his death to pass for natural. It being discovered to be otherwise, however, diligent search was made for the criminals, who were punished according to their deserts. During the reign of Tizoc, the Alcolhuacans made war upon the Huexotzincas, ruined their city, and conquered their territory. Nezahualpilli also, the Acolhuacan monarch, though he had already several wives, had not made any of them queen, having wished to confer that honour upon one of the royal family of Mexico. Tizoc readily gave him one of his grand-daughters, who had a sister of singular beauty named *Xocotzin*. The friendship betwixt these two ladies was such, that the one could not think of being separated from the other; for which reason the new queen sought and obtained permission to take her sister along with her to Tezcuco. Xocotzin had not been long there before the king fell in love with her, and married her with the title of queen likewise. Soon after this second marriage, the first queen brought forth a son named *Cacamotzin*, who succeeded him in the throne, and was afterwards taken prisoner by the Spaniards.

64 Ahuitzotl dedicates a temple with a multitude of human victims.

Ahuitzotl, the brother of Tizoc, succeeded him in the kingdom of Mexico. His first object was to finish the great temple begun by his predecessor; and such was the number of workmen, that it was completed in four years. During the time that it was building, the king employed himself in making war with different nations, reserving all the prisoners he took for victims at the dedication of the temple. The number of prisoners sacrificed at this dedication is said by Torquemada to have been 72,324; by other historians 64,060. The miserable victims were ranged in two files, each a mile and an half in length, terminating at the temple. The same year another temple was built by a feudatory lord, in imitation of the great one built by the king; at the dedication of which a vast number of prisoners were also sacrificed. These temples were dedicated in 1486. In 1487 happened a violent earthquake; and Chimalpopoca king of Acolhuacan died, who was succeeded by Totoquihuatzin II.

65 His conquests.

The remainder of the life of Ahuitzotl was a continued series of wars, in all of which he proved ultimately successful, extending the Mexican dominions as far as Guatimala, 900 miles to the south-east of Mexico. In only one expedition the Mexicans were defeated with disgrace. This happened in 1496, when they suddenly, and as appears without any provocation, entered the vale of Atlixco in an hostile manner,

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manner. So unexpected was the invasion, that the inhabitants of Atlixco knew only of the intention of their enemies by seeing them in arms in their country. Finding it impossible to raise in an instant a sufficient force among themselves, they applied to their neighbours, the Huexotzincas. On their arrival at the city, which it seems had already been rebuilt since its destruction by the Acolhuacans, they found a most celebrated captain, named Tolteeatl, amusing himself at foot-ball. Being informed of the arrival of the Mexican army, he instantly quitted his diversion to repair to Atlixco; where, to show his contempt for the enemy, he entered the battle unarmed.—He supplied himself with armour by knocking down the first Mexican he met with his fist, and seizing his armour. He then attacked the enemy with such fury, and was so well seconded by his troops, that the Mexicans were totally defeated; and, in consideration of his signal bravery, the Huexotzincas made him the chief of their republic. He had not continued in his new office more than a year, however, when, finding himself unqualified for being legislator to such turbulent subjects as he had to deal with, he quitted his dignity and his country at once; and crossing the mountains with some other nobles, came to Tlalmanalco, where he was put to death, with all his companions, by order of Ahuizotl.

66 His death.

Ahuizotl died in 1502, of a disorder produced by a contusion in his head. Of the cause of which we have the following account: In 1498, the king, thinking that the navigation of the lake of Mexico was become difficult on account of the scarcity of water, formed a project of supplying the deficiency from a fountain which supplied the Cojoacanese, and called upon the lord of the district to give orders for that purpose. This nobleman represented that the spring was not constant; that sometimes it was dry, and at others ran so abundantly that it might occasion some disaster in his court. Ahuizotl, however, supposing this to be a pretence, renewed his order, and put the nobleman to death for insisting upon his objection. He then caused a spacious aqueduct to be constructed from Cojoacan to Mexico; and the water was brought in with a great many superstitious ceremonies. That very year, however, there fell such quantities of rain, that the waters of the lake, augmented also by those of the spring, overflowed the city, so that the streets were filled with sailing vessels, and some houses were destroyed. The king happening to be one day in a lower apartment of his palace, the waters entered with such rapidity and violence that he was obliged to fly; and the door being low, he struck his head with such force against the top, that he never recovered the effects of the contusion. This inundation was followed by a famine, all the maize being rotted by the water.

67 Montezuma II.

At the time of Ahuizotl's death, the Mexican empire was brought to its utmost extent. His successor, Montezuma *Xocojotzin*, or Montezuma *Junior*, was a person of great bravery, besides which he was likewise a priest, and held in great estimation on account of his gravity and the dignity of his deportment. His election was unanimous; and the nobles congratulated themselves on the happiness the country was to enjoy under him, little thinking how short the duration of their happiness or of their empire was to be.

The first care of the new monarch, as usual, was to procure victims for the barbarous sacrifices to be made at his coronation. The people of Atlixco, who had again shaken off the Mexican yoke, were the sufferers on this occasion, being once more reduced, though not without great loss on the part of the Mexicans, some of whose bravest officers perished in the war. The ceremony of coronation was performed with such pomp as had never been seen before in Mexico; but no sooner was this ceremony over than Montezuma began to discover a pride which nobody had suspected before. All his predecessors had been accustomed to confer offices upon persons of merit, and those who appeared the most able to discharge them, without any partiality as to birth or wealth. Montezuma, however, disapproved of the conduct of his predecessors, under pretence that the plebeians should be employed according to their rank; for that in all their actions the baseness of their birth and the meanness of their education appeared: and in consequence of this maxim he deprived all the commoners of the offices they held about the court, declaring them incapable of holding any for the future. All the royal servants now were people of rank. Besides those who lived in the palace, 600 feudatory lords and nobles came to pay court to him. They passed the whole day in the antichamber, where none of their servants were permitted to enter; conversing in a low voice, and waiting the orders of their sovereign.—The servants of these lords were so numerous that they occupied three small courts of the palace, and many waited in the streets. The women were not less numerous. All these last were confined in one vast seraglio, under the care of some noble duennas, who kept a strict watch over their conduct. From this collection the emperor selected such as he liked best for himself, giving away the rest; and so well did he acquit himself in his matrimonial capacity, that *an hundred and fifty* of his wives are said to have been pregnant at once.

68 His excessive haughtiness.

The pride of Montezuma was no less conspicuous in the ceremonials than in the magnificence of his court. None durst enter the palace without pulling off his shoes and stockings at the gate; neither durst they appear pompously dressed in the imperial presence; this being deemed a want of respect to majesty.—All who entered the hall of audience, before speaking to the king, made three bows; at the first, saying *Lord!* at the second, *My Lord!* and at the third, *Great Lord!* They spoke low, and with the head inclined, receiving the answer which the king gave them by secretaries, with as great humility as if it had been the voice of a deity; and no person in taking leave ever turned his back on the throne. When this mighty emperor went abroad, he was carried on the shoulders of the nobility, in a litter covered with a rich canopy, and attended by a numerous retinue of courtiers: and wherever he passed, every person shut their eyes, as fearing to be dazzled with the splendor of Majesty. When he alighted from the litter to walk on foot, carpets were spread on the ground, that the emperor might not be permitted to touch the earth with his feet.

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[68] Magnificence displayed in his palace.

In every respect Montezuma kept up, as far as was possible, this extravagant appearance of dignity. His kitchen-utensils were of the finest earthen ware, and his table-cloths and napkins of the finest cotton; but none of these ever served the emperor more than once, being immediately made a present of to some nobleman. The vessels in which his chocolate and other drinks from cocoa were prepared, were all of gold, or some beautiful sea-shell, or naturally formed vessels, curiously varnished. He had also gold plate, but it was used only on particular occasions in the temple. The number and variety of his dishes astonished the Spaniards. Cortes says, that they covered the floor of a great hall; and that there were dishes of every kind of game, fish, fruit, or herbs, in the country. This dinner was carried in state by three or four hundred of the young nobility, who retired as soon as the king sat down to table: and that the meat might not grow cold, each plate was furnished with a chafing-dish. The king marked with a rod the dishes he chose for himself, and the rest were distributed among the nobility in the antichamber. Before he sat down, four of the most beautiful women of his seraglio supplied him with water to wash his hands, and continued standing all the time of his dinner, along with six of his principal ministers and his carvers.

Montezuma took great delight in the cleanliness of his person, and of every thing about him. He bathed regularly every day, and had baths in all his palaces. Every day he wore four dresses, never using again those which he had put off, but reserving them as largesses for the nobility, or those who had distinguished themselves in war.

69 Displeases his subjects.

The expence of all this, and many other instances of magnificence, rendered the emperor very disagreeable to a great number of his subjects; though others were pleased with the readiness he showed to relieve the necessities of individuals, and his generosity in rewarding his generals and ministers who deserved it.—Among other actions worthy of imitation, he appointed the city of Colhuacan as an hospital for all invalids, who, after having faithfully served the crown, either in the civil or military line, required a provision on account of their age and infirmities. In this place they were maintained and attended at the expence of the king.

70 His unsuccessful war with Tlascala.

The reign of Montezuma, even before the arrival of the Spaniards, was far from being so glorious with regard to his successes in war as those of his predecessors had been. He reduced indeed one rebellious province, and conquered another which had never before been subjugated; but in his war with Tlascala, he was by no means successful. This was but a small republic at no great distance from the capital, but the inhabitants were remarkable for their bravery and independent spirit. The neighbouring states, however, who had been reduced by the Mexicans, envious of their liberty and prosperity, exasperated the Mexicans against them, by representing that the Tlascalans were desirous of making themselves masters of the maritime provinces on the Mexican gulf, and that by their commerce with these provinces they were encreasing their wealth and power, and gaining the hearts of the people with whom they were to traffic. In consequence of this representation, strong garrisons were placed on the frontiers of Tlascala, to obstruct the commerce of the inhabitants, and thus to deprive them of the means of obtaining some of the necessaries of life. The Tlascalans complained; but received no other answer than that the king of Mexico was lord of all the world, and that the Tlascalans must submit to pay tribute to him. The Tlascalans returned a spirited answer, to this insolent speech, and began to fortify their frontier.—They had already enclosed all the lands of the republic with entrenchments; and to these they now added a wall of six miles in length on the west side, where an invasion was most to be apprehended; and so well did they defend themselves, that though they were frequently attacked by the neighbouring states in alliance with Mexico, or subject to it, not one of them was able to wrest a foot of ground from them. Thus a continual series of wars and engagements took place between the states of Mexico and this republic, which continued till the arrival of the Spaniards. The most remarkable occurrences in these wars are the exploits of a Tlascalan general named Tlahuicol. His courage and strength were so great that his enemies fled wherever he appeared. The sword with which he fought was so weighty, that no man of ordinary strength could lift it from the ground. At last, however, having in the heat of an engagement got into a marsh, his great strength was of no use to him, so that he was taken prisoner, put into a strong cage, and carried to Mexico. The emperor, in consideration of his extraordinary qualities, gave him liberty to return to his own country: but this he absolutely refused, saying, that he wished to die, like other prisoners, in honour of their god. In this he persisted obstinately for several years; until at last Montezuma resolved to comply with his barbarous desire; and he was permitted to die by the gladiatorian sacrifice, to be afterwards described, in which the prisoner was allowed, though under great disadvantages, to fight for his life. He was opposed by several brave men, one at a time, of whom he killed eight, and wounded twenty more; until, falling almost dead by a violent blow he received on the head, he was carried to the temple, and there sacrificed.

71 Exploits and death of Tlahuicol.

72 Apprehension entertained by the Mexicans of the arrival of a new people.

During the remainder of Montezuma's reign, the empire was disturbed by various rebellions, of which the accounts are not sufficiently interesting to merit a particular detail; but in the year 1508, Montezuma began to entertain apprehensions of that fatal event which at length overtook him. An expedition having been undertaken against a very distant region named Amatla, the army, in marching over a lofty mountain, were attacked by a furious north-wind, accompanied with snow; which made great havock in the army, many of them perishing with cold, and others being killed by the trees rooted up by the wind. The remains of the army continued their march to Amatla, where they were almost all killed in battle. By this and other calamities, together with the appearance of a comet, the Mexicans were thrown into the utmost consternation. Montezuma was so terrified by these omens, that, having in vain consulted his astrologers, he applied to the king of Acolhuacan, who was reported to be very skilful in divination. Nezahualpilli having conferred with him at length upon the subject, told Montezuma, that the comet presaged some calamity which was about to befal their kingdoms by the arrival

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arrival of a new people: but this being unsatisfactory to the emperor, the king of Acolhuacan challenged him to a game at foot-ball, staking the truth of his prediction on the issue of the game. Montezuma lost the game, but did not yet acquiesce in the truth of his prediction. He therefore applied to a celebrated astrologer, whom it seems he had not yet consulted; but he confirmed the interpretation of Nezahualpilli; for which the emperor caused his house to be pulled down, and himself buried in the ruins.

73 Story of the resurrection of a princess.

Many other presages of the arrival of the Spaniards are related. The following, though apparently the most incredible of them all, seems to be believed by Clavigero. "A sister of Montezuma, named Papantzin, who had been married to the governor of Tlatelolco, lived in his palace after he was dead to the year 1509, when she died of old age. The day after her burial, a child of five or six years old happened to pass from her mother's apartment to that of the major-domo of the deceased princess. In passing by the child saw the princess sitting upon the steps of the fountain where she had been accustomed to bathe, and heard herself called by the name of *cocoton*, a Mexican expression of endearment, signifying "little girl." The child, incapable from its age of reflecting on the death of the princess, approached without fear, and was desired to call the wife of her major-domo. The woman caressed the child, and told her that the princess was dead; but being importuned and pulled by the gown, she at last went; but no sooner saw the princess than she fainted. The child then ran to call her mother, who with two other women came to the assistance of the wife of the major-domo; but they also would have fainted, had not the princess called to them and assured them that she was really alive. Having caused them call the major-domo, she desired him to go and tell Montezuma what he had seen. But he, dreading the severity of the emperor, durst not undertake the task. She then desired him to go to Tezenco, and tell Nezahualpilli that she wished to see him. He came accordingly, and at her desire brought Montezuma; whom she informed, that during the time she lay entranced, she had seen a vision. The main purport of this vision was to announce to her, that all her forefathers were damned; that another race of men should arrive, who should conquer the kingdom, and introduce the true religion; and "as soon as the bath should be published and made known, which would wash away sin, she should be the first to accept of it."

74 The expectation of the Mexicans accounted for.

There can be but very little doubt that this story is a fiction of the Spanish priests, tho' it cannot be doubted that the Mexicans had some expectations of the arrival of the Spaniards among them at the time they actually came. This, however, we may account for without having recourse to any thing the least supernatural, or out of the ordinary course of things. The West India islands had been discovered by Columbus, in 1492: he had made frequent voyages, and had even discovered the continent. Settlements had been made; the Spaniards had shown their prowess and their cruelty; and we are not to doubt, that many of the islanders would quit their habitations to escape the fury of the invaders. It would naturally occur to these fugitives, that the arms of these new comers could not be resisted by those of the western nations, while their relentless cruelty might easily suggest that they would destroy all before them. From the year 1492, therefore, to 1508, there was time enough for this report to have reached Mexico: and we can only attribute it to the barbarous state in which the Americans were, that the Spaniards were not perfectly known and described before their arrival.

75 Vast numbers of human sacrifices.

But whatever were the omens by which the arrival of the Spaniards was announced, they appear to have had no effect in working any reformation upon Montezuma or his Mexicans. Instead of relaxing any thing from the barbarity of their religion, they seem to have augmented it. Wars were carried on every where, and prisoners sacrificed by thousands; insomuch, that Montezuma finding the stone on which the prisoners were sacrificed too small, he caused one of monstrous size to be put in its place. It was dragged along by an immense number of people: but in passing a wooden bridge over a canal, in the entry of the city, the bridge broke down by its enormous weight, and dragged several people into the water, among whom was the high priest, who had accompanied it on the road, scattering incense as he went along. This misfortune disconcerted them considerably: nevertheless the stone, by dint of excessive labour, was got up again, and consecrated by the murder of 12,200 prisoners. The time, however, was now at hand when this horrible and never-ceasing butchery was to be ended, and a most severe vengeance to overtake the perpetrators. The Spaniards having established themselves pretty well in the island of Cuba and Hispaniola, now prepared to explore the continent also, with a view to extend the dominions of their sovereign, and to satiate, if possible, their own appetites for wealth.

76 Conquest of Mexico undertaken by Cortes.

Mexico itself was first discovered, though imperfectly, by a Spaniard named *Nunez de Balboa*; but in 1518, the conquest of it was undertaken by a celebrated adventurer named *Ferdinando Cortes*. It was not, however, without great difficulty that he got his expedition set on foot; being persecuted by the Spanish governors in the West-Indies, so that he was at last obliged to throw off his allegiance to them, and proceed without any commission. However, on the 10th of February, 1519, he set sail from the Havannah in Cuba; and soon landed on the island of Cozomel, on the coast of Yucatan, discovered the preceding year. Here he joined one of his officers, named *Pedro d'Alvaredo*, who had arrived some days before, and collected some booty, and taken a few prisoners. But the general severely censured his conduct; and the prisoners were dismissed after they had been informed by an Indian interpreter named *Melchior*, that such injuries were entirely disagreeable to the intentions and wishes of Cortes. Here he mustered his army, and found that it amounted to 508 soldiers, 16 horsemen, and 109 mechanics, pilots, and mariners. Having encouraged his men by a proper speech, and released, by means of some Indian ambassadors, a Spaniard named *Jerom de Aguilar*, who had been detained a prisoner for eight years, he proceeded to the river Tobasco, where he hoped to be received in a friendly manner, as one *Grijalva* had been a short time before; but from some unknown cause, he was violently attacked by them: however, the superiority of the Spanish arms soon decided the victory, and the inhabitants were

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were obliged to own the king of Castile as their sovereign.

77 Receives an embassy from the emperor of Mexico.

The Spaniards then continued their course westward, to the harbour of St Juan de Ullua; where they were met by two Mexican canoes, who carried two ambassadors from the emperor of that country, and showed the greatest signs of peace and amity. Their language was unknown to Aguilar; but one of the female prisoners abovementioned understood it, and translated it into the Yucatan tongue; after which Aguilar interpreted the meaning in Spanish. This slave was afterwards named *Donna Marina*, and proved very useful in their conferences with the natives.

78 State of the empire at that time.

At this time the Mexican empire, according to Dr Robertson, was arrived at a pitch of grandeur to which no society had ever attained in so short a period. Though it had subsisted only for 130 years, its dominion extended from the north to the south sea; over territories stretching about 500 leagues from east to west, and more than 200 from north to south; comprehending provinces not inferior in fertility, population, and opulence, to any in the torrid zone.—Though by nature Montezuma possessed a good deal of courage and resolution; yet from the first moment that the Spaniards appeared on his coast, he discovered symptoms of timidity and embarrassment, and all his subjects were embarrassed as well as himself. The general dismay which took place on this occasion was partly owing to the strange figure the Spaniards made, and the prodigious power of their arms; but partly also to the following circumstance. An opinion prevailed almost universally among the Americans, that some dreadful calamity impended over their heads, from a race of formidable invaders who should come from regions towards the rising sun, to over-run and desolate their country. The origin of this we have already attempted to explain; but as the Mexicans were more prone to superstition than any people in the new world, they were more deeply affected with the appearance of the Spaniards, whom they instantly supposed to be the instruments destined to bring about that fatal revolution which they dreaded; and this produced the embassy abovementioned.

By means of his two interpreters, Donna Marina and Aguilar, Cortes learned that the chiefs of the Mexican embassy were deputies from Pilpatoe and Teutile; the one governor of a province under the emperor, and the other the commander of all his forces in that province: the purport of their embassy was, to inquire what his intentions were in visiting their coasts, and to offer him what assistance he might need in order to continue his voyage. Cortes, in his turn, also professed the greatest friendship; and informed the ambassadors, that he came to propose matters of the utmost consequence to the welfare of the prince and his kingdom; which he would more fully unfold in person to the governor and the general. Next morning, without waiting for any answer, he landed his troops, his horses, and his artillery; began to erect huts for his men, and to fortify his camp.—The natives, instead of opposing the entrance of these fatal guests into their country, assisted them in all their operations with an alacrity which they had ere long reason to repent.

79 Cortes lands and fortifies his camp.

The next day the ambassadors had a formal audience; at which Cortes acquainted them, that he came from Don Carlos of Austria, king of Castile, the greatest monarch of the east, and was intrusted with propositions of such moment, that he would impart them to none but the emperor himself, and therefore required to be conducted immediately to the capital. This demand produced the greatest uneasiness; and the ambassadors did all in their power to dissuade Cortes from his design, endeavouring to conciliate his good-will by the presents sent him by Montezuma. These they introduced with great parade, and consisted of fine cotton-cloth, of plumes of various colours, and of ornaments of gold and silver to a considerable value, the workmanship of which appeared to be as curious as the materials were rich. But these presents served only to excite the avidity of the Spaniards, and to encrease their desire for becoming masters of a country which abounded with so many precious commodities. Cortes indeed could scarcely restrain himself so far as to hear the arguments made use of by the ambassadors to dissuade him from going to the capital; and, in a haughty, determined tone, insisted on his former demand of being admitted to a personal interview with their sovereign.

80 The Indians endeavour to dissuade him from going to the capital, but in vain.

During this conversation, some painters in the retinue of the Mexican chiefs had been diligently employed in delineating, upon white cotton clothes, figures of the ships, horses, artillery, soldiers, and whatever else attracted their eyes as singular. When Cortes observed this, and was informed that these pictures were to be sent to Montezuma, he resolved to render the representation still more striking and interesting. The trumpets, by his orders, sounded an alarm; the troops formed in order of battle, and showed their agility and strength in the best manner they could; while the artillery was pointed against the neighbouring trees, among which it made dreadful havock. The Indians for some time looked on with silent astonishment; but at the explosion of the cannon, some fled, others fell to the ground, and all were so confounded, that Cortes found it difficult to quiet and compose their minds.

81 Montezuma made acquainted with his design.

When the painters had exerted their utmost efforts in representing all these wonderful things, messengers were immediately dispatched to Montezuma with the pictures, and a full account of every thing that had passed since the arrival of the Spaniards, together with some European curiosities to Montezuma; which, though of no great value, Cortes believed would be acceptable on account of their novelty. The Mexican monarchs, in order to obtain the earliest information of every occurrence in all parts of their empire, had couriers posted at proper stations along the principal roads; and as these were trained to agility by a regular education, they conveyed intelligence with surprising rapidity. Though the city in which Montezuma resided was above 180 miles from St Juan de Ullua, Cortes's presents were carried thither, and an answer returned to his demands, in a few days. As the answer was unfavourable, Montezuma had endeavoured to mollify the Spanish general by the richness of his presents. These consisted of the manufactures of the country; cotton-stuffs so fine, and of such

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delicate texture, as to resemble silk; pictures of animals, trees, and other natural objects, formed with feathers of different colours, disposed and mingled with such skill and elegance as to rival the works of the pencil in truth and beauty of imitation. But what chiefly attracted their attention, were too large plates of a circular form; one of massive gold representing the sun, the other of silver representing the moon. These were accompanied with bracelets, collars, rings, and other trinkets of gold; and that nothing might be wanting which could give the Spaniards a complete idea of what the country afforded, some boxes filled with pearls, precious stones, and grains of gold unwrought, as they had been found in the mines or rivers, were sent along with the rest. Cortes received all with an appearance of the most profound respect for Montezuma; but when the Mexicans, presuming upon this, informed him, that their master, though he desired him to accept of what he had sent as a token of his regard for the prince whom he represented, would not give his consent that foreign troops should approach nearer to his capital, or even allow them to continue longer in his dominions, Cortes declared, in a manner more resolute and peremptory than formerly, that he must insist on his first demand; as he could not, without dishonour, return to his own sovereign until he was admitted into the presence of the prince whom he was appointed to visit in his name. The Mexicans were astonished at the sight of a man who dared to oppose the will of their emperor; but not being willing to come to an open rupture with such formidable enemies, with much ado they prevailed upon Cortes to promise that he would not move from his present camp until the return of a messenger whom they sent to Montezuma for further instructions.

82 Sends an unfavourable answer, but accompanied with rich presents.

83 Cortes still insists on his demands,

The pusillanimity of the Indian monarch afforded time to the Spaniards to take measures which would have been out of their power had they been vigorously attacked on their first refusal to obey his orders. Cortes used every method of securing the affections of the soldiers; which indeed was very necessary, as many of them began to exclaim against the rashness of his attempt in leading them against the whole force of the Mexican empire. In a short time Teutile arrived with another present from Montezuma, and together with it delivered the ultimate orders of that monarch to depart instantly out of his dominions; and when Cortes, instead of complying with his demands, renewed his request of audience, the Mexican immediately left the camp with strong marks of surprise and resentment. Next morning, none of the natives appeared; all friendly correspondence seemed to be at an end, and hostilities were expected to commence every moment. A sudden consternation ensued among the Spaniards, and a party was formed against him by the adherents of Velasques; who took advantage of the occasion, and deputed one of their number, a principal officer, to remonstrate, as if in name of the whole army, against his rashness, and to urge the necessity of his returning to Cuba. Cortes received the message without any appearance of emotion; and as he well knew the temper and wishes of his soldiery, and foresaw how they would receive a proposition so fatal to all the splendid hopes and schemes which they had been forming with such complacency, he pretended to comply with the request now made him, and issued orders that the army should be in readiness next day to embark for Cuba. Upon hearing this, the troops, as Cortes had expected, were quite outrageous: they positively refused to comply with these orders, and threatened immediately to choose another general if Cortes continued to insist on their departure.

84 Montezuma peremptorily commands him to leave his dominions.

Our adventurer was highly pleased with the disposition which now appeared among his troops: nevertheless, dissembling his sentiments, he declared, that his orders for embarking had proceeded from a persuasion that it was agreeable to his fellow-soldiers, to whose opinion he had sacrificed his own; but now he acknowledged his error, and was ready to resume his original plan of operation. This speech was highly applauded; and Cortes, without allowing his men time to cool, set about carrying his designs into execution. In order to give a beginning to a colony, he assembled the principal persons in his army, and by their suffrages elected a council and magistrates, in whom the government was to be vested. The persons chosen were most firmly attached to Cortes; and the new settlement had the name of *Villa Rica de la Vera Cruz*; that is, the rich town of the true cross.

85 Villa Rica founded.

Before this court of his own making, Cortes did not hesitate at resigning all his authority, and was immediately re-elected chief-justice of the colony, and captain-general of his army, with an ample commission, in the king's name, to continue in force till the royal pleasure should be farther known. The soldiers eagerly ratified their choice by loud acclamations; and Cortes, now considering himself as no longer accountable to any subject, began to assume a much greater degree of dignity, and to exercise more extensive powers than he had done before. Some of the soldiers began to exclaim against the proceedings of the council as illegal; but the ringleaders were instantly sent on board the fleet loaded with irons. By this timely severity the rest were overawed; and Cortes, knowing of how great importance unanimity was to his future success, soon found means to reconcile those who were most disaffected: to which purpose a liberal distribution of the Mexican gold, both among friends and foes, contributed not a little.

86 The government of the new colony vested in Cortes.

Cortes having thus strengthened himself as well as he could, resolved to advance into the country; and to this he was encouraged by the behaviour of the cacique or petty prince of Zempoalla, a considerable town at no great distance. This prince, though subject to Montezuma, was exceedingly impatient of the yoke; and so filled with dread and hatred of the emperor, that nothing could be more acceptable to him than an appearance of being delivered from that subjection; and a deliverance of this kind he now hoped from the Spaniards. For this reason, he sent ambassadors to Cortes, with offers of friendship, which were gladly accepted by him; and in consequence of the alliance, he very soon visited Zempoalla. Here he was received in the most friendly manner imaginable, and had a respect paid towards him almost equivalent to adoration. The cacique informed him of many particulars relating to the character of Montezuma.—He told him that he was a tyrant, haughty, cruel, and

87 Makes an alliance with the cacique of Zempoalla.

88 Character of Montezuma given by the cacique.

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and suspicious; who treated his own subjects with arrogance, ruined the conquered provinces by his extortions, and often tore their sons and daughters from them by violence; the former to be offered as victims to his gods, the latter to be reserved as concubines for himself and favourites. Cortes, in reply, artfully insinuated, that one great object of the Spaniards in visiting a country so remote from their own was, to redress grievances, and to relieve the oppressed; and having encouraged him to hope for this interposition in due time, continued his march to Quiabislan, the territory of another cacique, and where, by the friendly aid of the Indians, a Spanish colony was soon formed.

During the residence of Cortes in these parts, he so far wrought on the minds of the caciques of Zempoalla and Quiabislan, that they ventured to insult the Mexican power, at the very name of which they had been formerly accustomed to tremble. Some of Montezuma's officers having appeared to levy the usual tribute, and to demand a certain number of human victims, as an expiation of their guilt in presuming to hold intercourse with those strangers whom the emperor had commanded to leave his dominions; instead of obeying his orders, they made them prisoners, treated them with great indignity, and, as their superstition was no less barbarous than Montezuma's, they threatened to sacrifice them to their gods. From this last danger, however, they were delivered by the interposition of Cortes, who manifested the utmost horror at the mention of such a deed. This act of rebellion firmly attached the two caciques to the interest of Cortes; and without hesitation they acknowledged themselves vassals of the king of Spain. Their example was followed by the Totonaques, a fierce people who inhabited the mountainous parts of the country. They willingly subjected themselves to the crown of Castile; and offered to accompany Cortes with all their forces in his march towards Mexico.

89 The caciques of Zempoalla, Quiabislan and some others, submit.

Though Cortes had now taken such measures as in a manner ensured his success; yet as he had thrown off all dependence on the governor of Cuba, who was his lawful superior, and apprehended his interest at court, he thought proper, before he set out on his intended expedition, to take the most effectual measures against the impending danger. With this view, he persuaded the magistrates of his colony to address a letter to the king, containing a pompous account of their own services, of the country they had discovered, &c. and of the motives which had induced them to throw off their allegiance to the governor of Cuba, and to settle a colony dependent on the crown alone, in which the supreme power civil as well as military had been vested in Cortes: humbly requesting their sovereign to ratify what had been done by his royal authority. Cortes himself wrote in a similar strain; but as he knew that the Spanish court, accustomed to the repeated exaggerations of American adventurers, would give little credit to the splendid accounts of New-Spain, if they were not accompanied with such a specimen of what it contained as would excite an high idea of its opulence, he solicited his soldiers to relinquish what they might claim as their part of the treasures which had hitherto been collected, in order that the whole might be sent to the king. Portocarrero and Montejo, the chief magistrates of the colony, were appointed to carry this present to Castile, with express orders not to touch at Cuba in their passage thither. But while a vessel was preparing for their departure, an unexpected event produced a general alarm. Some soldiers and sailors, secretly disaffected to Cortes, formed a design of seizing one of the brigantines, and making their escape to Cuba, in order to give such intelligence to the governor as might enable him to intercept the vessel which was to carry the treasure and the dispatches to Spain. This conspiracy was conducted with profound secrecy; but at the moment when every thing was ready for execution, the secret was discovered by one of the associates. The latent spirit of disaffection which Cortes was now too well convinced had not been extinguished amongst his troops, gave him very great uneasiness. The only method which he could think of to prevent such conspiracies for the future was, to destroy his fleet; and thus deprive his soldiers of every resource except that of conquest: and with this proposal he persuaded his men to comply. With universal consent therefore the ships were drawn ashore, and, after being stripped of their sails, rigging, iron-work, and whatever else might be of use, they were broke in pieces.

90 The Magistrates of Villa Rica send a letter to the king of Spain in favour of Cortes.

91 Cortes burns his fleet.

Cortes having thus rendered it necessary for his troops to follow wherever he chose to lead, began his march to Zempoalla with 500 infantry, 15 horse, and six field-pieces. The rest of his troops, consisting chiefly of such as from age or infirmity were less fit for active service, he left as a garrison in Villa Rica, under the command of Escalante, an officer of merit, and warmly attached to his interest. The cacique of Zempoalla supplied him with provisions; and with 200 of those Indians called *Tamames*, whose office, in a country where tame animals were unknown, was to carry burdens and perform all manner of servile labour. He offered likewise a considerable body of troops; but Cortes was satisfied with 400; taking care, however, to choose persons of such note, that they might serve as hostages for the fidelity of their master.

Nothing memorable happened till the Spaniards arrived on the confines of the republic of Tlascala. The inhabitants of that province were warlike, fierce, and revengeful, and had made considerable progress in agriculture and some other arts. They were implacable enemies to Montezuma; and therefore Cortes hoped that it would be an easy matter for him to procure their friendship. With this view, four Zempoallans of high rank were sent ambassadors to Tlascala, dressed with all the badges of that office usual among the Indians. The senate were divided in their opinions with regard to the proposals of Cortes: but at last Magiscatzin, one of the oldest senators, and a person of great authority, mentioned the tradition of their ancestors, and the revelations of their priests; that a race of invincible men, of divine origin, who had power over the elements, should come from the east to subdue their country. He compared the resemblance which the strangers bore to the persons figured in the tradition of Mexico, their dominion over the elements of fire, air, and water; he reminded the

92 Sends ambassadors to the republic of Tlascala.

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the ſenate of their prodigies, omens, and ſignals, which had lately terrified the Mexicans, and indicated ſome very important event; and then declared his opinion, that it would be raſhneſs to oppoſe a force apparently aſſiſted by heaven, and men who had already proved, to the ſad experience of thoſe who oppoſed them, that they were invincible. This orator was oppoſed by Xicotencal, who endeavoured to prove that the Spaniards were at beſt but powerful magicians: that they had rendered themſelves obnoxious to the gods by pulling down their images and altars, (which indeed Cortes had very imprudently done at Zempoalla); and of conſequence, that they might eaſily be overcome, as the gods would not fail to reſent ſuch an outrage. He therefore voted for war, and adviſed the cruſhing of theſe invaders at one blow.

93 The Tlaſcalans reſolve on war.

The advice of Xicotencal prevailed; and in conſequence of it, the ambaſſadors were detained; which giving Cortes the alarm, he drew nearer the city of Tlaſcala. In this tranſaction we may eaſily ſee how little the Tlaſcalans, notwithſtanding all their ferocity, were ſkilled in military affairs. They ſuffered Cortes, with his army drawn up in good order, to paſs a ſtrong wall between two mountains, which might have been very advantageouſly defended againſt him. He had not advanced far beyond this paſs, however, before a party of Tlaſcalans with plumes were diſcovered, which denoted that an army was in the field. Theſe he drove before him by a detachment of ſix horſe, obliged them to join another party, and then reinforcing the advanced detachment, charged the enemy with ſuch vigour that they began to retire. Five thouſand Tlaſcalans, whom Xicotencal had placed in ambuſh, then ruſhed out of their hiding places, juſt as the infantry came up to aſſiſt their ſlender body of cavalry. The enemy attacked with the utmoſt fury; but were ſo much diſconcerted by the firſt diſcharge of the fire-arms, that they retreated in confuſion, furniſhing the Spaniards with an opportunity of purſuing them with great ſlaughter. Cortes, however, ſuppoſing that this could not be their whole force, advanced with the utmoſt caution, in order of battle, to an eminence, from whence he had a view of the main body of the Tlaſcalan army commanded by Xicotencal, conſiſting of no fewer than 40,000 men. By theſe the ſmall army of Cortes was entirely ſurrounded; which Xicotencal no ſooner perceived, than he contracted the circle with incredible diligence, while the Spaniards were almoſt overwhelmed with ſhowers of arrows, darts, and ſtones. It is impoſſible but in this caſe many of the Spaniards muſt have periſhed, had it not been for the inſufficiency of the Indian weapons. Their arrows and ſpears were headed only with flint, or the bones of fiſhes; their ſtakes hardened in the fire, and wooden ſwords, though deſtructive weapons among naked Indians, were eaſily turned aſide by the Spaniſh bucklers, and could hardly penetrate the quilted jackets which the ſoldiers wore. Theſe circumſtances gave the Spaniards a prodigious advantage over them: and therefore the Tlaſcalans, notwithſtanding their valour and ſuperiority in number, could accompliſh no more in the preſent inſtance, than to kill one horſe and ſlightly wound nine ſoldiers.

The Tlaſcalans being taught by this, and ſome ſubſequent encounters, how much they were inferior to the Spaniards, began to conceive them to be really what Magiſcatzin had ſaid: a ſuperior order of beings, againſt whom human power could not prevail. In this extremity they had recourſe to their prieſts, requiring them to reveal the cauſes of ſuch extraordinary events, and to declare what means they ſhould take to repel ſuch formidable invaders. The prieſts, after many ſacrifices and incantations, delivered their reſponſe, That theſe ſtrangers were the offſpring of the ſun, procreated by his animating energy in the regions of the eaſt; that, by day, while cheriſhed with the influence of his parental beams, they were invincible; but by night, when his reviving heat was withdrawn, their vigour declined and faded like herbs in the field, and they dwindled down into mortal men. In conſequence of this, the Tlaſcalans acted in contradiction to one of their moſt eſtabliſhed maxims in war, and ventured to attack the enemy in the night-time, hoping to deſtroy them when infeebled and ſurpriſed. But the Spaniſh centinels having obſerved ſome extraordinary movements among the Tlaſcalans, gave the alarm. Immediately the troops were under arms, and ſallying out, defeated their antagoniſts with great ſlaughter, without allowing them to approach the camp. By this diſaſter the Tlaſcalans were heartily diſpoſed to peace; but they were at a loſs to form an adequate idea of the enemies they had to deal with. They could not aſcertain the nature of theſe ſurpriſing beings, or whether they were really of a benevolent or malignant diſpoſition. There were circumſtances in their behaviour which ſeemed to favour each opinion. On the one hand, as the Spaniards conſtantly diſmiſſed the priſoners whom they took, not only without injury, but often with preſents of European toys, and renewed their offers of peace after every victory; this lenity amazed people accuſtomed to the exterminating ſyſtem of war known in America, and who ſacrificed and devoured without mercy all the captives taken in battle; and diſpoſed them to entertain ſentiments favourable to their humanity. But, on the other hand, as Cortes had ſeized 50 of their countrymen who brought proviſions to their camp, and cut of their heads; this bloody ſpectacle, added to the terror occaſioned by the fire-arms and horſes, filled them with dreadful ideas of their ferocity. Accordingly they addreſſed them in the following manner: "If (ſaid they) you are divinities of a cruel and ſavage nature, we preſent to you five ſlaves, that you may drink their blood and eat their fleſh. If you are mild deities, accept an offering of incenſe and variegated plumes. If you are men, here is meat, bread, and fruit, to nouriſh you." After this addreſs, the peace was ſoon concluded, to the great ſatisfaction of both parties. The Tlaſcalans yielded themſelves as vaſſals to the crown of Caſtile, and engaged to aſſiſt Cortes in all his operations; while he took the republic under his protection, and promiſed to defend their perſons and poſſeſſions from injury and violence.

95 But are defeated, and ſue for peace.

95 Which is granted.

96 Great diſtreſſes of the Spaniards.

This reconciliation took place at a very ſeaſonable juncture for the Spaniards. They were not only worn out with inceſſant toil, but ſo deſtitute of neceſſaries, that they had no other ſalve to dreſs their wounds but what

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what was composed of the fat of Indians whom they had slain. Their distresses, in short, were arisen to such an height, that they had began to murmur, and even to despair, insomuch that Cortes had much difficulty in restraining them within any kind of bounds; but the submission of the Tlascalans, and their own triumphant entry into the city, where they were received with the reverence due to a superior order of beings, banished at once all memory of past sufferings, dispelled every anxious thought, and fully convinced them that they could not be resisted by any power in America.

Cortes left no method untried to gain the favour and confidence of the Tlascalans; which, however, he had almost entirely lost, by his untimely zeal in destroying their idols, as he had done those of Zempoalla. But he was deterred from this rash action by his chaplain, father Bartholomew de Olmedo; and left the Tlascalans in the undisturbed exercise of their superstition, requiring only that they should desist from their horrid practice of offering human victims. As soon as his troops were fit for service, he resolved to continue his march towards Mexico, notwithstanding the remonstrances of the Tlascalans, who looked upon his destruction as unavoidable if he put himself into the power of such a faithless prince as Montezuma. But the emperor, probably intimidated with the fame of his exploits, had resolved to admit his visit; and informed Cortes, that he had given orders for his friendly reception at Cholula, the next place of any consequence on the road to Mexico. In this, however, he was, by no means sincere. Cholula was looked upon by all the inhabitants of the empire as a very holy place; the sanctuary and chief seat of their gods, to which pilgrims resorted from every province, and a greater number of human victims were offered in its principal temple, than even in that of Mexico. Montezuma therefore, invited the Spaniards thither, either from some superstitious hopes that the gods would not suffer this sacred mansion to be defiled; or from a belief, that he himself might there find an opportunity of cutting them off with more certainty of success, when under the immediate protection of his gods. Cortes, however, was received with much seeming cordiality; but 6000 Tlascalan troops, who accompanied him, were obliged to remain without the town, as the Cholulans refused to admit their ancient enemies within their precincts. Yet two of these by disguising themselves, got into the city, and acquainted Cortes, that they observed the women and children belonging to the principal citizens, retiring every night in a great hurry, and that six children had been sacrificed in the great temple; a sign that some warlike enterprise was at hand. At the same time Donna Marina, the interpreter, received information from an Indian woman of distinction, whose confidence she had gained, that the destruction of the Spaniards was concerted; that a body of Mexican troops lay concealed near the town; that some of the streets were barricaded, in others deep pits or trenches were dug, and slightly covered over, as traps into which the horse might fall; that stones and missive weapons were collected on the tops of the temples, with which to overwhelm the infantry; that the fatal hour was already at hand, and their ruin unavoidable. Cortes, alarmed at this news, secretly arrested three of the chief priests, from whom he extorted a confession that confirmed the intelligence he had already received. As not a moment was to be lost, he instantly resolved to prevent his enemies, and to inflict on them such dreadful vengeance as might strike Montezuma and his subjects with terror. For this purpose the Spaniards and Zempoallans were drawn up in a large court, which had been allotted for their quarters, near the centre of the town; the Tlascalans had orders to advance; the magistrates and chief citizens were sent for under various pretexts, and seized. On a signal given, the troops rushed out, and fell upon the multitude, destitute of leaders, and so much astonished, that the weapons dropped from their hands, and they stood motionless, and incapable of defence. While the Spaniards attacked them in front, the Tlascalans did the same in the rear; the streets were filled with slaughter; the temples, which afforded a retreat to the priests, and some leading men, were set on fire, and they perished in the flames. This scene of horror continued two days, during which the wretched inhabitants suffered all that the destructive rage of the Spaniards, or the implacable revenge of their Indian allies, could inflict. At length the carnage ceased, after the slaughter of 6000 Cholulans, without the loss of a single Spaniard.—Cortes then released the magistrates; and reproaching them bitterly for their intended treachery, declared, that as justice was now appeased, he forgave the offence; but required them to recal the inhabitants who had fled, and re-establish order in the town. Such was the ascendant that the Spaniards had now obtained over this superstitious race, that this order was instantly complied with; and the city was in a few days again filled with people, who paid the most respectful service to those men whose hands were stained with the blood of their relations and fellow-citizens.

97 Cortes continues his march for Mexico.

98 Treachery of Montezuma and the Cholulans.

99 Severe punishment of the Cholulans.

From Cholula, Cortes advanced directly towards Mexico; and throughout the whole of his journey, was entertained with accounts of the oppressions and cruelty of Montezuma. This gave him the greatest hope of accomplishing his design; as he now perceived that the empire was entirely divided, and no sort of unanimity prevailed among them. No enemy appeared to check his progress. Montezuma was quite irresolute; and Cortes was almost at the gates of the capital before the emperor had determined whether to receive him as a friend, or oppose him as an enemy. But as no sign of open hostility appeared, the Spaniards, without regarding the fluctuations of Montezuma's sentiments, continued their march to Mexico, with great circumspection and the strictest discipline, though without seeming to suspect the prince whom they were about to visit.

100 Disaffection of Montezuma's subjects.

When they drew near the city, about 1000 persons, who appeared to be of distinction, came forth to meet them, adorned with plumes, and clad in mantles of fine cotton. Each of these, in his order, passed by Cortes, and saluted him according to the mode deemed most respectful and submissive in their country. They announced the approach of Montezuma himself, and soon after his harbingers came in sight. There appeared first 200 persons in an uniform dress, with large plumes of feathers, alike in fashion, marching two and two, in deep silence, barefooted, with their eyes fixed on the ground. These were followed by a company of higher rank,

101 Meeting of Cortes and Montezuma.

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rank, in their most showy apparel; in the midst of whom was Montezuma, in a chair or litter richly ornamented with gold, and feathers of various colours. Four of his principal favourites carried him on their shoulders, others supported a canopy of curious workmanship over his head. Before him marched three officers, with rods of gold in their hands, which they lifted up on high at certain intervals; and at that signal all the people bowed their heads, and hid their faces, as unworthy to look on so great a monarch.—When he drew near, Cortes dismounted, advancing towards him with officious haste, and in a respectful posture. At the same time Montezuma alighted from his chair, and leaning on the arms of two of his near relations, approached with a slow and stately pace, his attendants covering the street with cotton cloths, that he might not touch the ground. Cortes accosted him with profound reverence, after the European fashion. He returned the salutation, according to the mode of his country, by touching the earth with his hand, and then kissing it. This ceremony, the customary expression of reverence from inferiors towards those who are above them in rank, appeared such amazing condescension in a proud monarch, who scarcely deigned to consider the rest of mankind as of the same species with himself, that all his subjects firmly believed those persons, before whom he humbled himself in this manner, to be something more than human. Accordingly, as they marched through the croud, the Spaniards frequently, and with much satisfaction, heard themselves denominated *teules*, or *divinities*. Nothing material passed in this first interview. Montezuma conducted Cortes to the quarters which he had prepared for his reception; and immediately took leave of him, with a politeness not unworthy of a court more refined. "You are now (says he), with your brothers, in your own house; refresh yourselves after your fatigue, and be happy until I return." The place allotted to the Spaniards for their lodging, was a house built by the father of Montezuma. It was surrounded by a stone wall, with towers at proper distances, which served for defence as well as for ornament; and its apartments and courts were so large as to accommodate both the Spaniards and their Indian allies. The first care of Cortes was to take precautions for his security, by planting the artillery so as to command the different avenues which led to it, by appointing a large division of his troops to be always on guard, and by posting sentinels at proper stations, with injunctions to observe the same vigilant discipline as if they were within sight of an enemy's camp.

In the evening, Montezuma returned to visit his guests, with the same pomp as in their first interview; and brought presents of such value, not only to Cortes and to his officers, but even to the private men, as proved the liberality of the monarch to be suitable to the opulence of his kingdom. A long conference ensued, in which Cortes learned what was the opinion of Montezuma with respect to the Spaniards. It was an established tradition, he told him, among the Mexicans, that their ancestors came originally from a remote region, and conquered the provinces now subject to his dominion: that after they were settled there, the great captain who conducted this colony, returned to his own country, promising, that at some future period his descendants should visit them, assume the government, and reform their constitutions and laws; that, from what he had heard and seen of Cortes and his followers, he was convinced that they were the very persons whose appearance and prophecies taught them to expect; that accordingly, he had received them, not as strangers, but as relations of the same blood and parentage, and desired that they might consider themselves as masters in his dominions; for both himself and his subjects should be ready to comply with their will and even to prevent their wishes. Cortes made a reply in his usual style with respect to the dignity and power of his sovereign, and his intention in sending him into that country; artfully endeavouring so to frame his discourse, that it might coincide as much as possible with the idea which Montezuma had formed concerning the origin of the Spaniards. Next morning, Cortes, and some of his principal attendants, were admitted to a public audience of the emperor. The three subsequent days were employed in viewing the city; the appearance of which, so far superior in the order of its buildings and the number of its inhabitants to any place the Spaniards had beheld in America, and yet so little resembling the structure of an European city, filled them with surprize and admiration.

102 Description of the city of Mexico.

Mexico, *Tenuchtitlan*, as it was anciently called by the natives, is situated in a large plain, environed by mountains of such height, that, though within the torrid zone, the temperature of its climate is mild and healthful. All the moisture which descends from the high grounds, is collected in several lakes, the two largest of which, of about 90 miles in circuit, communicate with each other. The waters of the one are fresh, those of the others are brackish. On the banks of the latter, and on some small islands adjoining to them, the capital of Montezuma's empire was built.—The access to the city was by artificial causeways or streets, formed of stones and earth, about 30 feet in breadth. As the waters of the lake, during the rainy season, overflowed the flat country, these causeways were of considerable length. That of Tacuba, on the west a mile and a half; that of Tezeuco, on the north-west three miles; that of Cuoyacan, towards the south six miles. On the east there was no causeway, and the city could be approached only by canoes. In each of these causeways were openings, at proper intervals, through which the waters flowed; and over these beams of timber were laid, which being covered with earth, the causeway or street had every where an uniform appearance. As the approaches to the city were singular, its construction was remarkable. Not only the temple of their gods, but the houses belonging to the monarch, and to persons of distinction, were of such dimensions, that, in comparison with any other buildings which had been discovered in America, they might be termed *magnificent*. The habitations of the common people were mean, resembling the huts of other Indians. But they were all placed in a regular manner, on the banks of the canals which passed thro' the city, in some of its districts, or on the sides of the streets which intersected it in other quarters. In several places were large openings or squares, one of which allotted for the great market, is said to have been so spacious, that 40,000 or 50,000 persons carried on traffic

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traffic there. In this city, the pride of the New World, and the noblest monument of the industry and art of man, while unacquainted with the use of iron, and destitute of aid from any domestic animal, the Spaniards, who are most moderate in their computations, reckon that there were at least 60,000 inhabitants.

103 Uneasiness of the Spaniards.

But how much soever the novelty of those objects might amuse or astonish the Spaniards, they felt the utmost solicitude with respect to their own situation.—From a concurrence of circumstances, no less unexpected than favourable to their progress, they had been allowed to penetrate into the heart of a powerful kingdom, and were now lodged in its capital, without having once met with open opposition from its monarch. The Tlascalans, however, had earnestly dissuaded them from placing such confidence in Montezuma as to enter a city of such a peculiar situation as Mexico, where that prince would have them at mercy, shut up as it were in a snare, from which it was impossible to escape. They assured them that the Mexican priests had, in the name of the gods, counselled their sovereign to admit the strangers into the capital, that he might cut them off there at one blow with perfect security. The Spaniards now perceived, too plainly, that the apprehensions of their allies was not destitute of foundation; that, by breaking the bridges placed at certain intervals on the causeways, or by destroying part of the causeways themselves, their retreat would be rendered impracticable, and they must remain cooped up in the centre of a hostile city, surrounded by multitudes sufficient to overwhelm them, and without a possibility of receiving aid from their allies. Montezuma had, indeed, received them with distinguished respect. But ought they to reckon upon this as real, or to consider it as feigned? Even if it were sincere, could they promise on its continuance? Their safety depended upon the will of a monarch in whose attachment they had no reason to confide; and an order flowing from his caprice, or a word uttered by him in passion, might decide irrevocably concerning their fate.

104 Some hostilities between the Spaniards and Mexicans.

These reflections, so obvious as to occur to the meanest soldier, did not escape the vigilant sagacity of their general. Before he set out from Cholula, Cortes had received advice from Villa Rica, that Qualpopoca, one of the Mexican generals on the frontiers, having assembled an army in order to attack some of the people whom the Spaniards had encouraged to throw off the Mexican yoke, Escalante had marched out with part of the garrison to support his allies: that an engagement had ensued, in which, though the Spaniards were victorious, Escalante, with seven of his men, had been mortally wounded, his horse killed, and one Spaniard had been surrounded by the enemy, and taken alive; that the head of this unfortunate captive, after being carried in triumph to different cities, in order to convince the people, that their invaders were not immortal, had been sent to Mexico. Cortes, though alarmed with this intelligence, as an indication of Montezuma's hostile intentions, had continued his march. But as soon as he entered Mexico, he became sensible, that, from an excess of confidence in the superior valour and discipline of his troops, as well as from the disadvantage of having nothing to guide him in an unknown country, but the defective intelligence which he received from people with whom his mode of communication was very imperfect, he had pushed forward into a situation, where it was difficult to continue, and from which it was dangerous to retire. Disgrace, and perhaps ruin, was the certain consequence of attempting the latter. The success of his enterprise depended upon supporting the high opinion which the people of New-Spain had formed with respect to the irresistible power of his arms. Upon the first symptom of timidity on his part, their veneration would cease, and Montezuma, whom fear alone restrained at present, would let loose upon him the whole force of his empire. At the same time, he knew that the countenance of his own sovereign was to be obtained only by a series of victories; and that nothing but the merit of extraordinary success could screen his conduct from the censure of irregularity. From all these considerations, it was necessary to maintain his station, and to extricate himself out of the difficulties in which one bold step had involved him, by venturing upon another still bolder.—The situation was trying, but his mind was equal to it; and after revolving the matter with deep attention, he fixed upon a plan no less extraordinary than daring.—He determined to seize Montezuma in his palace, and carry him a prisoner to the Spanish quarters. From the superstitious veneration of the Mexicans for the person of their monarch, as well as their implicit submission to his will, he hoped, by having Montezuma in his power, to acquire the supreme direction of their affairs; or at least, with such a sacred pledge in his hands, he made no doubt of being secure from any effort of their violence.

105 Cortes resolves to seize Montezuma in his palace.

This he immediately proposed to his officers. The timid startled at a measure so audacious, and raised objections. The more intelligent and resolute, conscious that it was the only resource in which there appeared any prospect of safety, warmly approved of it, and brought over their companions so cordially to the same opinion, that it was agreed instantly to make the attempt. At his usual hour of visiting Montezuma, Cortes went to the palace, accompanied by Alvarado, Sandoval, Lugo, Velasquez de Leon, and Davila, five of his principal officers, and as many trusty soldiers. Thirty chosen men followed, not in regular order, but sauntering at some distance, as if they had no object but curiosity; small parties were posted at proper intervals, in all the streets leading from the Spanish quarters to the court; and the remainder of his troops, with the Tlascalan allies, were under arms, ready to sally out on the first alarm. Cortes and his attendants were admitted without suspicion; the Mexicans retiring, as usual, out of respect. He addressed the monarch in a tone very different from that which he had employed in former conferences; reproaching him bitterly as the author of the violent assault made upon the Spaniards by one of his officers, and demanding public reparation for the loss which he had sustained by the death of some of his companions, as well as for the insult offered to the great prince whose servants they were. Montezuma, confounded at this unexpected accusation, and changing colour, either from the consciousness of guilt, or from feeling the indignity with which he was treated, asserted his own innocence with great earnestness; and as a proof of it, gave orders instantly to bring Qualpopoca and his accomplices prisoners to Mexico. Cortes replied, with seeming complaisance, that a declaration so respectable left no doubt remaining

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remaining in his own mind, but that something more was requisite to satisfy his followers, who would never be convinced that Montezuma did not harbour hostile intentions against them, unless, as an evidence of his confidence and attachment, he removed from his own palace, and took up his residence in the Spanish quarters, where he should be served and honoured as became a great monarch. The first mention of so strange a proposal, bereaved Montezuma of speech, and almost of motion. At length he haughtily answered, "That persons of his rank were not accustomed voluntarily to give up themselves as prisoners; and were he mean enough to do so, his subjects would not permit such an affront to be offered to their sovereign." Cortes, unwilling to employ force, endeavoured alternately to soothe and intimidate him. The altercation became warm; and having continued above three hours, Velasquez de Leon, an impetuous and gallant young man, exclaimed with impatience, "Why waste more time in vain? Let us either seize him instantly, or stab him to the heart." The threatening voice and fierce gestures with which these words were uttered, struck Montezuma. The Spaniards, he was sensible, had now proceeded so far, as left him no hope that they would recede. His own danger was imminent, the necessity unavoidable. He saw both; and abandoning himself to his fate, complied with their request.

106 The emperor carried to the Spanish quarters.

His officers were called. He communicated to them his resolution. Though astonished and afflicted, they presumed not to question the will of their master, but carried him in silent pomp, all bathed in tears, to the Spanish quarters. When it was known that the strangers were conveying away the emperor, the people broke out into the wildest transports of grief and rage, threatening the Spaniards with immediate destruction, as the punishment justly due to their impious audacity. But as soon as Montezuma appeared with a seeming gaiety of countenance, and waved his hand, the tumult was hushed; and upon his declaring it to be of his own choice that he went to reside for some time among his new friends, the multitude, taught to revere every intimation of their sovereign's pleasure, quietly dispersed.

107 Cortes rules the empire.

The Spaniards at first pretended to treat Montezuma with great respect; but soon took care to let him know that he was entirely in their power. Cortes wished that the shedding the blood of a Spaniard, should appear the most henious crime that could be committed; and therefore not only took a most exemplary vengeance on those who had been concerned in the affair of Villa Rica, but even put the emperor himself in chains, till the execution of the Mexican general was over. By these and other insults, he at last gained entirely, the ascendant over this unhappy monarch; and he took care to improve his opportunity to the utmost. He sent his emissaries into different parts of the kingdom, accompanied with Mexicans of distinction, who might serve both to guide and to protect them. They visited most of the provinces, viewed their soil and productions, surveyed with particular care the districts which yielded gold or silver, pitched upon several places as proper for future colonies, and endeavoured to prepare the minds of the people for submitting to the Spanish yoke: and while they were thus employed, Cortes, in the name, and by the authority of Montezuma, degraded some of the principal officers in the empire, whose abilities or independent spirit excited his jealousy; and substituted in their place persons who he imagined would be more obsequious. One thing, however, was still wanting to complete his security. He wished to have such a command of the lake as might ensure a retreat, if, either from levity or disgust, the Mexicans should take arms against him, and break down the bridges or causeways, in order to enclose him in the city. In order to obtain this without giving disgust to the emperor or his court, Cortes artfully inflamed the curiosity of the Indians with accounts of the Spanish shipping, and those floating palaces that moved with such velocity on the water, without the assistance of oars; and when he found that the monarch himself was extremely desirous of seeing such a novelty, he gave him to understand, that nothing was wanting to his gratification besides a few necessaries from Vera Cruz, for that he had workmen in his army capable of building such vessels. The bate took with Montezuma; and he gave immediate orders that all his people should assist Cortes in whatever he should direct concerning the shipping. By this means, in a few days, two brigantines were got ready, full-rigged and equipped; and Montezuma was invited on board, to make the first trial of their sailing, of which he could form no idea. Accordingly he embarked for this purpose, and gave orders for a great hunting upon the water, in order that all his people might be diverted with the novelty presented by the Spaniards. On the day appointed, the royal equipage was ready early in the morning; and the lake was covered with a multitude of boats and canoes loaded with people. The Mexicans had augmented the number of their rowers on board the royal barges, with an intention to disgrace the Spanish vessels, which they regarded as clumsy, unwieldy, and heavy. But they were soon undeceived; a fresh gale started up, the brigantines hoisted sail, to the utter astonishment of all the spectators, and soon left all the canoes behind; while the monarch exulted in the victory of the Spaniards, without once considering that now he had effectually rivetted his own chains.

108 By a pretence, he obtains leave to build two brigantines on the lake.

109 Montezuma owns himself a vassal to the king of Spain.

Cortes having obtained this important point, resolved to put the condescension of the emperor to a trial still more severe. He urged Montezuma to acknowledge himself a vassal to the crown of Castile; to hold his crown of him as superior, and to subject his dominions to the payment of an annual tribute. With this requisition, humiliating as it was, Montezuma complied. He called together the chief men of his empire, and, in a solemn harangue, reminded them of the traditions and prophecies which led them to expect the arrival of a people sprung from the same stock with themselves, in order to take possession of the supreme power; he declared his belief that the Spaniards were this promised race; and that therefore he recognised the right of their monarch to govern the Mexican empire, would lay his crown at his feet, and obey him as a tributary. While uttering these words, Montezuma discovered how deeply he was affected in making such a sacrifice. Tears and groans frequently interrupted his discourse. The first mention of such a resolution struck the assembly dumb with astonishment. This was followed by a sullen murmur of sorrow mingled with indignation; which indicated some violent eruption of rage to be near at hand. This Cortes foresaw, and seasonably interposed to prevent it, by declaring that

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that his master had no intention to deprive Montezuma of the royal dignity, or to make any innovation upon the constitution and laws of the Mexican empire. This assurance, added to their dread of the Spanish arms, and the authority of their monarch's example, extorted the consent of the assembly; and the act of submission and homage was executed with all the formalities which the Spaniards pleased to prescribe.

110 The Spaniards divide their treasure.

Montezuma, at the request of Cortes, accompanied this profession of fealty and homage with a magnificent present to his new sovereign; and, after his example, his subjects brought in very liberal contributions. The Spaniards then collected all the treasure which had been either voluntarily bestowed upon them at different times by Montezuma, or had been extorted from his people under various pretences; and having melted the gold and silver, the value of these, without including jewels and ornaments of various kinds, which were preserved on account of their curious workmanship, amounted to 600,000 pesos. The soldiers were impatient to have it divided; and Cortes complied with their desire. A fifth of the whole was set apart as the tax due to the king. Another fifth was allowed to Cortes as commander. The sums advanced by the governor of Cuba, who had originally fitted out the expedition, were then deducted. The remainder was then divided among the army, including the garrison of Vera Cruz, in proportion to their different ranks; and after so many deductions, the share of a private man did not exceed 100 pesos. This sum fell so far below their sanguine expectations, that it required all the address, and no small exertions of the liberality of Cortes, to prevent an open mutiny. However, he at last restored tranquillity; but had no sooner escaped this danger, than he involved himself, by his imprudent zeal for religion, in one much worse. Montezuma, though often importuned, had obstinately refused to change his religion, or abolish the superstitious rites which had been for such a long time practised throughout his dominions. This at last transported the Spaniards with such rage, that, in a sally of zeal, he led out his soldiers in order to throw down the idols in the great temple by force. But the priests taking arms in defence of their altars, and the people crowding with great ardour to support them, Cortes's prudence over-ruled his zeal, and induced him to desist from his rash attempt, after dislodging the idols from one of the shrines, and placing in their stead an image of the Virgin Mary.

111 Cortes attempts to destroy the Mexican idols.

112 Which produces a general disaffection.

From this moment the Mexicans began to meditate the expulsion or the destruction of the Spaniards. The priests and leading men held frequent meetings with Montezuma for this purpose. But as any violent attempt might have proved fatal to the captive monarch, it was thought proper first to try more gentle means. Having called Cortes into his presence, he observed, that now, as all the purposes of his embassy were fully accomplished, the gods had declared their will, and the people signified their desire, that he and his followers should instantly depart out of the empire. With this he required them to comply, or unavoidable destruction would fall suddenly on their heads. This unexpected requisition, as well as the manner in which it was delivered, alarmed Cortes. However, he supposed that more might be gained by a feigned compliance than by open resistance; and therefore replied with great composure, that he had already begun to prepare for his return; but as he had destroyed the vessels in which he arrived, some time was requisite for building other ships. This appeared reasonable; and a number of Mexicans were sent to Vera Cruz to cut down timber, and some Spanish carpenters were appointed to superintend the work.

113 The Spaniards are commanded to depart.

114 An armament sent from Cuba against Cortes.

Cortes flattered himself, that, during this interval, he might either find means to avert the threatened danger, or receive such reinforcements as would enable him to defend himself. Nine months had now elapsed since Portocarrero and Montejo had sailed with his dispatches to Spain; and he daily expected a return with a confirmation of his authority from the king, without which all that had done served only to mark him out as an object of punishment. While he remained in great anxiety on this account, news were brought that some ships had appeared on the coast. These were imagined by Cortes to be a reinforcement sent him from Spain: but his joy was of short continuance, for a courier very soon arrived from Vera Cruz, with certain information that the armament was fitted out by Velasquez, the governor of Cuba; and instead of bringing succours, threatened them with immediate destruction.

Velasquez had been excited to this hostile measure chiefly through the indiscretion, or rather treachery, of the messengers of Cortes; who, contrary to his express injunctions, had landed on the island of Cuba, and given intelligence of all that had passed: and Velasquez, transported with rage at hearing of the proceedings of Cortes, had now sent against him this armament; consisting of 18 ships, which carried 80 horsemen, 800 infantry, of which 80 were musketeers, and 120 cross-bowmen, commanded by a brave officer named *Pamphilo de Narvaez;* whose instructions were, to seize Cortes and his principal officers, to send them prisoners to him, and then to complete the discovery and conquest of the country in his name. This proved a most afflicting piece of news to Cortes. However, thinking it imprudent to attempt any thing against his countrymen at first by force, he sent his chaplain Olmedo with proposals of accommodation. Narvaez rejected his proposals with scorn; but his followers were less violent in their resentments. Olmedo delivered many letters to them, either from Cortes himself, or from his officers their ancient friends and companions. These Cortes had artfully accompanied with presents of rings, chains of gold, and other trinkets of value; which inspired those needy adventurers with high ideas of the wealth he had acquired, and with envy of the good fortune of those who were engaged in his service. Some, from hopes of becoming sharers in these rich spoils, declared for an immediate accommodation; while others were for the same pacific measure, through fear of subverting the Spanish power entirely in a country where it was so imperfectly established. Narvaez disregarded both; and, by a proclamation, denounced Cortes and his adherents rebels, and enemies to their country.

115 Which is defeated by that general.

Cortes having now no resource but in war, left 150 men under the command of Pedro de Alvarado, an officer of great bravery, and much respected by

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by the Mexicans, to guard the capital and the captive emperor; while he himself marched with the remainder, to meet his formidable opponent, who had taken possession of Zempoalla. Even after being reinforced by Sandoval his governor of Vera Cruz, the force of Cortes did not exceed 250 men. He hoped for success chiefly from the rapidity of his motions and the possibility of surprising his enemies; and as he chiefly dreaded their cavalry, he armed his soldiers with long spears, accustoming them to that deep and compact arrangement which the use of this formidable weapon enabled them to assume. As he advanced, however, he repeated his proposals of accomodation; but these being constantly rejected, and a price set upon his head, he at last attacked Narvaez in the night-time, entirely defeated and took him prisoner, obliging all his troops to own allegiance to himself.

Nothing could be more seasonable than this victory, by which Cortes found his army very considerably increased; for most of the soldiers of Narvaez chose rather to follow Cortes than to return to Cuba, whither the conqueror had offered to send them if they chose. His affairs at Mexico, in the mean time, were in the utmost danger of being totally ruined; and had this decisive victory been delayed but a few days longer, he must have come too late to save his companions. A short time after the defeat of Narvaez, a courier arrived from Mexico with the disagreeable intelligence that the Mexicans had taken arms; and having seized and destroyed the two brigantines which he had built in order to secure the command of the lake, had attacked the Spaniards in their quarters, killed some, and wounded many more, burnt their magazine of provisions, and, in short, carried on hostilities with such fury, that though Alvarado and his men defended themselves with undaunted resolution, they must either be cut off by famine, or sink under the multitude of their enemies. This revolt was excited by motives which rendered it still more alarming. On the departure of Cortes for Zempoalla, the Mexicans flattered themselves, that the long-expected opportunity of restoring their sovereign to liberty, and driving out the Spaniards, was arrived; and consultations were accordingly held for bringing about both these events. The Spaniards in Mexico, conscious of their own weakness, suspected and dreaded these machinations; but Alvarado, who had neither the prudence nor the address of Cortes, took the worst method imaginable to overcome them. Instead of attempting to soothe or cajole the Mexicans, he waited the return of one of their solemn festivals, when the principal persons in the empire were dancing, according to custom, in the court of the great temple; he seized all the avenues which led to it; and, allured partly by the rich ornaments which they wore in honour of their gods, and partly by the facility of cutting off at once the authors of that conspiracy which he dreaded, he fell upon them, unarmed and unsuspicious of danger, and massacred a great number; none escaping but such as made their way over the battlements of the temple. An action so cruel and treacherous filled not only the city, but the whole empire, with indignation and rage; and the Mexicans immediately proceeded in the manner above-mentioned.

116 Dangerous situation of the Spaniards left at Mexico.

Cortes advanced with the utmost celerity to the relief of his distressed companions; but as he passed along, had the mortification to find that the Spaniards were generally held in abhorrence. The principal inhabitants had deserted the towns through which he passed; no person of note appeared to meet him with the usual respect; nor were provisions brought to his camp as usual. Notwithstanding these signs of aversion and horror, however, the Mexicans were so ignorant of the military art, that they again permitted him to enter the capital without opposition; though it was in their power to have easily prevented him, by breaking down the bridges and causeways which led to it.

117 Cortes allowed to return to Mexico;

Cortes was received by his companions with the utmost joy; and this extraordinary success so far intoxicated the general himself, that he not only neglected to visit Montezuma, but expressed himself very contemptuously concerning him. These expressions being reported among the Mexicans, they all at once flew to arms, and made such a violent and sudden attack, that all the valour and skill of Cortes were scarce sufficient to repel them. This produced great uneasiness among the soldiers of Narvaez, who had imagined there was nothing to do but to gather the spoils of a conquered country. Discontent and murmurings, however, were now of no avail; they were inclosed in an hostile city, and, without some extraordinary exertions, were inevitably undone. Cortes therefore, made a desperate sally; but, after exerting his utmost efforts for a whole day, was obliged to retire with the loss of 12 killed, and upwards of 60 wounded. Another sally was attempted with the like bad success, and in it Cortes himself was wounded in the hand.

118 But is furiously attacked by the natives.

The Spanish general was now thoroughly convinced of his error; and therefore betook himself to the only resource which was left; namely, to try what effect the interposition of Montezuma would have to soothe or overawe his subjects. When the Mexicans approached the next morning to renew the assault, that unfortunate prince, at the mercy of the Spaniards, and reduced to the sad necessity of becoming the instrument of his own disgrace, and of the slavery of his people, advanced to the battlements in his royal robes, and with all the pomp in which he used to appear on solemn occasions. At the sight of their sovereign, whom they had been long accustomed to reverence almost as a god, the Mexicans instantly forebore their hostilities, and many prostrated themselves on the ground: but when he addressed them in favour of the Spaniards, and made use of all the arguments he could think of to mitigate their rage, they testified their resentment with loud murmurings; and at length broke forth with such fury, that before the soldiers, appointed to guard Montezuma, had time to cover him with their shields, he was wounded with two arrows, and a blow on his temple with a stone struck him to the ground. On seeing him fall, the Mexicans instantly fled with the utmost precipitation: but the unhappy monarch, now convinced that he was become an object of contempt even to his own subjects, obstinately refused

119 Montezuma killed.

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120 A terrible engagement between the Spaniards and Mexicans.

refused all nourishment; and thus in a short time ended his days.

On the death of Montezuma, Cortes having lost all hope of bringing the Mexicans to any terms of peace prepared for retreat. But his antagonists, having taken possession of a high tower in the great temple, which overlooked the Spanish quarters, and placing there a garrison of their principal warriors, the Spaniards were so much exposed to their missile weapons that none could stir without danger of being killed or wounded. From this post, therefore, it was necessary to dislodge them at any rate; and Juan de Escobar, with a large detachment of chosen soldiers, was ordered to make the attack. But Escobar, though a valiant officer, and though he exerted his utmost efforts, was thrice repulsed. Cortes, however, sensible that not only his reputation, but the safety of his army, depended on the success of this assault, caused a buckler to be tied to his arm, as he could not manage it with his wounded hand, and rushed with his drawn sword among the thickest of the combatants. Encouraged by the presence of their general, the Spaniards returned to the charge with such vigour, that they gradually forced their way up the steps, and drove the Mexicans to the platform at the top of the tower. There a dreadful carnage began; when two young Mexicans of high rank, observing Cortes, as he animated his soldiers, resolved to sacrifice their own lives in order to cut off the author of so many calamities which desolated their country. They approached him in a suppliant posture, as if they intended to lay down their arms; and seizing him in a moment, hurried him towards the battlements, over which they threw themselves headlong, in hopes of dragging him along with them. But Cortes, by his strength and agility, disengaged himself from their grasp; so that the two Mexicans perished alone.

As soon as the Spaniards became masters of the tower, they set fire to it, and without further molestation continued the preparations for their retreat. This became the more necessary, as their enemies, astonished at this last effort of their valour, had now entirely changed their system of hostility; and, instead of incessant attacks, endeavoured by barricading the streets, and breaking down the causeways, to cut off the communication of the Spaniards with the continent, and thus to starve an enemy whom they could not subdue. The first point to be determined was, whether they should march out openly in the face of day, when they could discern every danger, or whether they should endeavour to retire secretly in the night. The latter was preferred, partly from hopes that the superstition of the Mexicans would prevent them from attacking them in the night, and partly from their own superstition in giving credit to the predictions of a private soldier, who pretended to astrology, and assured them of success if they retreated in this manner. Towards midnight, therefore, they began their march, in three divisions. Sandoval led the van; Pedro Alvarado and Velasquez de Leon had the conduct of the rear; and Cortes commanded in the centre, where he placed the prisoners, among whom were a son and two daughters of Montezuma, together with several Mexicans of distinction; the artillery, baggage, and a portable bridge of timber intended to be laid over the breaches in the causeway. They marched in profound silence along the causeway which led to Tacuba, because it was shorter than any of the rest, and, lying most remote from the road towards Tlascala and the sea-coast, had been left most entire by the Mexicans.

121 Cortes retreats with great loss.

They reached the first breach in the causeway without molestation, hoping that their retreat was undiscovered. But the Mexicans had not only watched all their motions, but made preparations for a most formidable attack. While the Spaniards were intent upon placing their bridges in the breach, and occupied in conducting their horses and artillery along it, they were suddenly alarmed with the sound of warlike instruments, and found themselves assaulted on all sides by an innumerable multitude of enemies. Unfortunately the wooden bridge was wedged so fast in the mud by the weight of the artillery, that it was impossible to remove it. Dismayed at this accident, the Spaniards advanced with precipitation to the second breach. The Mexicans hemmed them in on every side; and though they defended themselves with their usual courage, yet, crowded as they were in a narrow causeway, their discipline and military skill were of little avail; nor did the obscurity of the night allow them to derive much advantage from their fire-arms or the superiority of their other weapons. At last the Spaniards, overborne with the numbers of their enemies, began to give way, and in a moment the confusion was universal. Cortes, with about 100 foot-soldiers, and a few horse, forced his way over the two remaining breaches in the causeway, the bodies of the dead serving to fill up the chasms, and reached the main land. Having formed them as soon as they arrived, he returned with such as were yet capable of service, to assist his friends in their retreat. He met with part of his soldiers who had forced their way through the enemy, but found many more overwhelmed by the multitude of their aggressors, or perishing in the lake; and heard the grievous lamentations of others whom the Mexicans were carrying off in triumph to be sacrificed to the god of war.

In this fatal retreat more than one half of Cortes's army perished, together with many officers of distinction. All the artillery, ammunition, and baggage, were lost; the greater part of the horses and above 2000 Tlascalans were killed, and only a very small part of their treasure saved. The first care of the Spanish general was to find some shelter for his wearied troops; for, as the Mexicans infested them on every side, and the people of Tacuba began to take arms, he could not continue in his present station. At last he discovered a temple seated on an eminence, in which he found not only the shelter he wanted, but some provisions; and though the enemy did not intermit their attacks throughout the day, they were without much difficulty prevented from making any impression. For six days after, they continued their march through a barren, ill cultivated, and thinly peopled country, where they were often obliged to feed on berries, roots, and the stalks of green maize; at the same time they were harrassed without intermission by large parties of Mexicans, who attacked them on all sides. On the sixth day they reached Otumba, not far from the road between Mexico and Tlascala. Early next morning they

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they began to advance towards it, flying parties of the enemy still hanging on their rear; and amidst the insults with which they accompanied their hostilities, Donna Marina remarked, that they often exclaimed with exultation, "Go on, robbers; go to the place where you shall quickly meet the vengence due to your crimes." The meaning of this threat the Spaniards did not comprehend, until they reached the summit of an eminence before them. There a spacious valley opened to their view, covered with a vast army as far as the eye could reach. The Mexicans, while with one body of their troops they harassed the Spaniards in their retreat, had assembled their principal force on the other side of the lake; and marching along the road which led directly to Tlascala, posted it in the plain of Otumba, through which they knew Cortes must pass. At the sight of this incredible multitude, which they could survey at once from the rising ground, the Spaniards were astonished, and even the boldest began to dispair. But Cortes, without allowing their fears time to operate, after warning them briefly that no alternative remained but to conquer or die, led them instantly to the charge. The Mexicans waited their approach with unusual fortitude: yet such was the superiority of the Spanish discipline and arms, that the impression of this small body was irresistible; and which ever way its force was directed, it penetrated and dispersed the most numerous battalions. But while these gave way in one quarter, new combatants advanced from another; and the Spaniards, though successful in every attack, were ready to sink under these repeated efforts, without seeing any end to their toil, or any hope of victory. At that time Cortes observed the great standard of the empire, which was carried before the Mexican general, advancing; and fortunately recollecting to have heard, that on the fate of it depended the event of every battle, he assembled a few of his bravest officers, whose horses were still capable of service, and, placing himself at their head, pushed towards the standard with such impetuosity that he bore down every thing before him. A chosen body of nobles, who guarded the standard, made some resistance, but were soon broken. Cortes, with a stroke of his lance, wounded the Mexican general, and threw him to the ground. One of his followers alighting, put an end to his life, and laid hold of the imperial standard. The moment that their leader fell, and the standard, towards which all directed their eyes, disappeared, an universal panic struck the Mexicans; and, as if the bond which held them together had been dissolved, every ensign was lowered, each soldier threw away his weapons, and fled with precipitation to the mountains. The Spaniards, unable to pursue them far, returned to collect the spoils of the field; and these were so valuable as to be some compensation for the wealth which they had lost in Mexico; for in the enemy's army were most of their principal warriors dressed out in their richest ornaments, as if they had been marching to assured victory.

122 The battle of Otumba.

123 Mexicans defeated.

The day after this important action (being July 8th 1520), the Spaniards entered the Tlascalan territories, where they were received with the most cordial friendship. Cortes endeavoured to avail himself of this disposition as much as possible; for which purpose he distributed among them the rich spoils taken at Otumba with such a liberal hand, that he made himself sure of obtaining from the republic whatever he should desire. He drew a small supply of amunition, and two or three field-pieces, from his stores at Vera Cruz. He dispached an officer of confidence with four ships of Narvaez's fleet to Hispaniola and Jamaica, to engage adventurers, and to purchase horses, gunpowder, and other military stores. And as he knew that it would be in vain to attempt the reduction of Mexico, unless he could secure the command of the lake, he gave orders to prepare, in the mountains of Tlascala, materials for building 12 brigantines, so that they might be carried thither in pieces, ready to be put together, and launched when he stood in need of their service. But, in the mean time, his soldiers, alarmed at the thoughts of being exposed to such calamities a second time, presented a remonstrance to their general, in which they represented the imprudence of attacking a powerful empire with his shattered forces, and formally required him to return back to Cuba. All the eloquence of Cortes could now only prevail with them to delay their departure for some time, when he promised to dismiss such as should desire it. However, this was only a pretence; for Cortes, in fact, had the conquest of Mexico as much at heart as ever. Without giving his soldiers an opportunity of caballing, therefore, he daily employed them against the people of the neighbouring provinces, who had cut off some detachments of Spaniards during his misfortunes at Mexico; and by which, as he was constantly attended with success, his men soon resumed their wonted sense of superiority.

124 Cortes receives an unexpected reinforcement.

But all the efforts of Cortes could have been of little avail, had he not unexpectedly obtained a reinforcement of Spanish soldiers. The governor of Cuba, to whom the success of Narvaez appeared an event of infallible certainty, having sent two small ships after him with new instructions, and a supply of men and military stores, the officer whom Cortes had appointed to command on the coast artfully decoyed them into the harbour of Vera Cruz, seized the vessels, and easily persuaded the soldiers to follow the standard of a more able leader than him whom they were destined to join. Soon after, three ships of more considerable force came into the harbour separately. These belonged to an armament fitted out by Francisco de Garay, governor of Jamaica, who had long aimed at dividing with Cortes the glory and gain of annexing the empire of Mexico to the crown of Castile. They had, however, unadvisedly made their attempt on the northern provinces, where the country was poor, and the inhabitants fierce and warlike; so that, after a succession of disasters, they were now obliged to venture into Vera Cruz, and cast themselves upon the mercy of their countrymen; and here they also were soon persuaded to throw off their allegiance to their master, and to enlist with Cortes. About the same time a ship arrived from Spain, freighted by some private adventurers, with military stores; and the cargo was eagerly purchased by Cortes, while the crew following the example of the rest, joined him at Tlascala.

From these various quarters, the army of Cortes

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was augmented with 180 men and 20 horses; by which means he was enabled to dismiss such of the soldiers of Narvaez as were most troublesome and discontented; after the departure of whom he still mustered 550 infantry, of whom 80 men were armed with muskets or cross-bows, 40 horsemen, and nine pieces of artillery. At the head of these, with 10,000 Tlascalans and other friendly Indians, he began his march towards Mexico, on the 28th of December, six months after his fatal retreat from that city.

125 He sets out again for Mexico.

The Mexicans, in the mean time, had made the best preparations they could for opposing such a formidable enemy. On the death of Montezuma, his brother Quetlavaca was raised to the throne; and he had an immediate opportunity of showing that he was worthy of their choice, by conducting in person those fierce attacks which obliged the Spaniards to retire from his capital. His prudence in guarding against the return of the invaders was equal to the spirit he had shown in driving them out. He repaired what the Spaniards had ruined in the city, strengthened it with such fortifications as his people could erect; and besides filling his magazines with the usual implements of war, gave directions to make long spears, headed with the swords and daggers which they had taken from the Spaniards, in order to annoy the cavalry. But in the midst of these preparations he was taken off by the small-pox; and Guatimozin, his nephew and son-in-law, raised to the throne.

126 Preparations of the Mexicans, for their defence.

As soon as Cortes entered the enemy's territories, he discovered various preparations to obstruct his progress. But his troops forced their way with little difficulty; and took possession of Tezeuco, the second city of the empire, situated on the banks of the lake, about 20 miles from Mexico. Here he determined to establish his head quarters, as the most proper station for launching his brigantines, as well as for making his approaches to the capital. In order to render his residence there more secure, he deposed the cazique or chief, who was at the head of that community under pretence of some defect in his title, and substituted in his place a person whom a faction of the nobles pointed out as the right heir of that dignity. Attached to him by this benefit, the new cazique and his adherents served the Spaniards with inviolable fidelity.

As the construction of the brigantines advanced slowly under the unskilful hands of soldiers and Indians, whom Cortes was obliged to employ in assisting three or four carpenters who happened fortunately to be in his service, and as he had not yet received the reinforcement which he expected from Hispaniola, he was not in a condition to turn his arms directly against the capital. To have attacked a city so populous, so well prepared for defence, and in a situation of such peculiar strength, must have exposed his troops to inevitable destruction. Three months elapsed before the materials for constructing the brigantines were finished, and before he heard any thing with respect to the success of his negociation in Hispaniola. This, however, was not a season of inaction to Cortes. He attacked successively several of the towns situated around the lake; and though all the Mexican power was exerted to obstruct his operations, he either compelled them to submit to the Spanish crown, or reduced them to ruins. Other towns he endeavoured to conciliate by more gentle means; and though he could not hold any intercourse with the inhabitants but by the intervention of interpreters, yet, under all the disadvantage of that tedious and imperfect mode of communication, he had acquired such thorough knowledge of the state of the country, as well as of the dispositions of the people, that he conducted his negociations and intrigues with astonishing dexterity and success. Most of the cities adjacent to Mexico were originally the capitals of small independent states; and some of them having been but lately annexed to the Mexican empire, still retained the remembrance of their ancient liberty, and bore with impatience the rigorous yoke of their new masters. Cortes having early observed symptoms of their disaffection, availed himself of this knowledge to gain their confidence and friendship. By offering with confidence to deliver them from the odious dominion of the Mexicans, and by liberal promises of more indulgent treatment if they would unite with him against their oppressors, he prevailed on the people of several considerable districts, not only to acknowledge the king of Castile as their sovereign, but to supply the Spanish camp with provisions, and to strengthen his army with auxiliary troops. Guatimozin, on the first appearance of defection among his subjects, exerted himself with vigour to prevent or to punish their revolt; but, in spite of his efforts, the spirit continued to spread. The Spaniards gradually acquired new allies; and with deep concern he beheld Cortes arming against his empire those very hands which ought to have been active in his defence, and ready to advance against the capital at the head of a numerous body of his own subjects.

127 Cortes makes great progress.

While, by these various methods, Cortes was gradually circumscribing the Mexican power within such narrow limits that his prospect of overturning it seemed neither to be uncertain nor remote, all his schemes were well nigh defeated by a conspiracy against his own person, and which was discovered only a short time before it was to have been executed. Though many were concerned, Cortes did not think proper to punish any more than the principal ringleader, whom he caused immediately to be hanged; and then, without allowing them leisure to ruminate on what had happened, and as the most effectual means of preventing the return of a mutinous spirit, he determined to call forth his troops immediately to action. Fortunately a proper occasion for this occurred, without his seeming to court it. He received intelligence, that the materials for building the brigantines were at length completely finished, and waited only for a body of Spaniards to conduct them to Tezeuco. The command of this convoy, consisting of 200 foot-soldiers, 15 horsemen, and 2 field-pieces, he gave to Sandoval, who by the vigilance, activity, and courage, which he manifested on every occasion, was growing daily in his confidence, and in the estimation of his fellow-soldiers. The service was no less singular than important; the beams, the planks, the masts, the cordage, the sails, the iron-work, and all the infinite variety of articles requisite for the construction of 13 brigantines were to be carried 60 miles over land, thro' a mountainous country, by people who were unacquainted with the ministry of domestic animals, or the aid of machines to facilitate any work of labour. The

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Tlaſcalans furniſhed 8000 *Tamenes*, an inferior order of men deſtined for ſervile taſks, to carry the materials on their ſhoulders, and appointed 15,000 warriors to accompany and defend them. Sandoval made the diſpoſition for their progreſs with great propriety, placing the Tamenes in the centre, one body of warriors in the front, another in the rear, with conſiderable parties to cover the flanks. To each of theſe he joined ſome Spaniards, not only to aſſiſt them in danger, but to accuſtom them to regularity and ſubordination. Parties of Mexicans frequently appeared hovering around them on the high grounds: but perceiving no proſpect of ſucceſs in attacking an enemy continually on his guard, and prepared to receive them, they did not venture to moleſt him; and Sandoval had the glory of conducting ſafely to Tezeuco a convoy on which all the future operations of his countrymen depended.

128 The Spaniards receive another reinforcement.

This was followed by another event of no leſs moment. Four ſhips arrived at Vera Cruz from Hiſpaniola, with 200 ſoldiers, 80 horſes, two battering cannon, and a conſiderable ſupply of ammunition and arms. Elevated with obſerving that all his preparatory ſchemes, either for recruiting his own army or impairing the force of the enemy, had now produced their full effect, Cortes, impatient to begin the ſiege in form, haſtened the launching of the brigantines. To facilitate this, he had employed a vaſt number of Indians, for two months, in deepening the ſmall rivulet which runs by Tezeuco into the lake, and in forming it into a canal near two miles in length; and though the Mexicans, aware of his intentions, as well as of the danger which threatened them, endeavoured frequently to interrupt the labourers, or to burn the brigantines, the work was at laſt completed. On the 28th of April, all the Spaniſh troops, together with auxiliary Indians, were drawn up on the banks of the canal; and with extraordinary military pomp, heightened and rendered more ſolemn by the celebration of the moſt ſacred rites of religion, the brigantines were launched. As they fell down the canal in order, Father Olmedo bleſſed them, and gave each its name. Every eye followed them with wonder and hope, until they entered the lake, when they hoiſted their ſails, and bore away before the wind. A general ſhout of joy was raiſed; all admiring that bold inventive genius, which, by means ſo extraordinary, that their ſucceſs almoſt exceeded belief, had acquired the command of a fleet, without the aid of which Mexico would have continued to ſet the Spaniſh power and arms at defiance.

129 The city beſieged.

Cortes determined to attack the city from three different quarters; from Tezeuco on the eaſt ſide of the lake, from Tacuba on the weſt, and from Cuyocan towards the ſouth. Thoſe towns were ſituated on the principal cauſeways which led to the capital, and intended for their defence. He appointed Sandoval to command in the firſt, Pedro de Alvarado in the ſecond, and Chriſtoval de Olid in the third; allotting to each a numerous body of Indian auxiliaries, together with an equal diviſion of Spaniards, who, by the junction of the troops from Hiſpaniola, amounted now to 86 horſemen, and 818 foot-ſoldiers; of whom 118 were armed with muſkets or croſs-bows. Their train of artillery conſiſted of three battering cannon, and 15 field-pieces. He reſerved for himſelf, as the ſtation of greateſt importance and danger, the conduct of the brigantines, each armed with one of his ſmall cannon, and manned with 25 Spaniards.

As Alvarado and Olid proceeded towards the poſts aſſigned them, they broke down the aqueducts which the ingenuity of the Mexicans had erected for conveying water into the capital, and, by the diſtreſs to which this reduced the inhabitants, gave a beginning to the calamities which they were deſtined to ſuffer. Alvarado and Olid found the towns, of which they were ordered to take poſſeſſion, deſerted by their inhabitants, who had fled for ſafety to the capital, where Guatimozin had collected the chief force of his empire, as there alone he could hope to make a ſucceſsful ſtand againſt the formidable enemies who were approaching to aſſault him.

130 The Spaniards defeat the Mexicans, and become maſters of the lake.

The firſt effort of the Mexicans was to deſtroy the fleet of brigantines, the fatal effects of whoſe operations they foreſaw and dreaded. Though the brigantines, after all the labour and merit of Cortes in forming them, were of inconſiderable bulk, rudely conſtructed, and manned chiefly with landmen, hardly poſſeſſed of ſkill enough to conduct them, they muſt have been objects of terror to a people unacquainted with any navigation but that of their lake, and poſſeſſed of no veſſel larger than a canoe. Neceſſity, however, urged Guatimozin to hazard the attack; and hoping to ſupply by numbers what he wanted in force, he aſſembled ſuch a multitude of canoes as covered the face of the lake. They rowed on boldly to the charge, while the brigantines, retarded by a dead calm, could ſcarcely advance to meet them. But as the enemy drew near, a breeze ſuddenly ſprung up; in a moment the ſails were ſpread, and the brigantines with irreſiſtible impetuoſity broke their feeble opponents, overſet many canoes, and diſſipated the whole armament with ſuch ſlaughter, as convinced the Mexicans, that the progreſs of the Europeans in knowledge and arts rendered their ſuperiority greater on this new element than they had hitherto found it by land.

From that time Cortes remained maſter of the lake: and the brigantines not only preſerved a communication between the Spaniards in their different ſtations, though at conſiderable diſtance from each other; but were employed to cover the cauſeways on each ſide, and keep off the canoes, when they attempted to annoy the troops as they advanced towards the city. He formed the brigantines in three diviſions, allotting one to each ſtation, with orders to ſecond the operations of the officer who commanded there. From all the three ſtations he puſhed on the attack againſt the city with equal vigour; but in a manner ſo very different from that whereby ſieges are conducted in regular war, as might appear no leſs improper than ſingular to perſons unacquainted with his ſituation. Each morning his troops aſſaulted the barricades which the enemy had erected on the cauſeways, forced their way over the trenches which they had dug, and through the canals where the bridges were broken down, and endeavoured to penetrate into the heart of the city, in hopes of obtaining ſome deciſive advantage, which might force the enemy to ſurrender, and terminate the war at once; but when the obſtinate valour of the Mexicans rendered the efforts of the day ineffectual, the Spaniards retired in

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in the evening to their former quarters. Thus their toil and danger were, in some measure, continually renewed, the Mexicans repairing in the night what the Spaniards had destroyed through the day, and recovering the posts from which they had driven them. But necessity prescribed this slow and untoward mode of operation. The number of his troops was so small, that Cortes durst not, with a handful of men, attempt to make a lodgement in a city where he might be surrounded and annoyed by such a multitude of enemies. The remembrance of what he had already suffered by the ill-judged confidence with which he had ventured into such a dangerous situation, was still fresh in his mind. The Spaniards, exhausted with fatigue, were unable to guard the various posts which they daily gained; and though their camp was filled with Indian auxiliaries, they durst not devolve this charge upon them, because they were so little accustomed to discipline, that no confidence could be placed in their vigilance. Besides this, Cortes was extremely solicitous to preserve the city as much as possible from being destroyed, both as he destined it to be the capital of his conquests, and wished that it might remain as a monument of his glory. From all these considerations, he adhered obstinately, for a month after the siege was opened, to the system which he had adopted. The Mexicans, in their own defence, displayed valour which was hardly inferior to that with which the Spaniards attacked them. On land, on water, by night and by day, one furious conflict succeeded to another. Several Spaniards were killed, more wounded, and all were ready to sink under the toils of unintermitting service, which were rendered more intolerable by the injuries of the season, the periodical rains being now set in with their usual violence.

Astonished and disconcerted with the length and difficulties of the siege, Cortes determined to make one great effort to get possession of the city before he relinquished the plan which he had hitherto followed, and had recourse to any other mode of attack. With this view, he sent instructions to Alvarado and Sandoval to advance with their divisions to a general assault, and took the command in person of that posted on the causeway of Cuyocan. Animated by his presence, and the expectation of some decisive event, the Spaniards pushed forward with irresistible impetuosity. They broke through one barricade after another, forced their way over the ditches and canals, and having entered the city, gained ground incessantly, in spite of the multitude and ferocity of their opponents. Cortes, though delighted with the rapidity of his progress, did not forget that he might still find it necessary to retreat and in order to secure it, appointed Julian de Alderete, a captain of chief note in the troops which he had received from Hispaniola, to fill up the canals and gaps in the causeway as the main body advanced. That officer deeming it inglorious to be thus employed, while his companions were in the heat of action and the career of victory, neglected the important charge committed to him, and hurried on inconsiderately to mingle with the combatants. The Mexicans, whose military attention and skill were daily improving, no sooner observed this, than they carried an account of it to their monarch.

Guatimozin instantly discerned the consequences of the error which the Spaniards had committed, and, with admirable presence of mind, prepared to take advantage of it. He commanded the troops posted in the front to slacken their efforts, in order to allure the Spaniards to push forward, while he dispatched a large body of chosen warriors through different streets some by land, and others by water, towards the great breach in the causeway, which had been left open. On a signal which he gave, the priests in the great temple struck the great drum consecrated to the god of war. No sooner did the Mexicans hear its doleful solemn sound, calculated to inspire them with contempt of death and with enthusiastic ardour, than they rushed upon the enemy with frantic rage. The Spaniards, unable to resist men urged on no less by religious fury than hope of success, began to retire at first leisurely, and with a good countenance: but as the enemy pressed on, and their own impatience to escape increased, the terror and confusion became so general, that when they arrived at the gap in the causeway, Spaniards and Tlascalans, horsemen and infantry, plunged in promiscuously, while the Mexicans rushed upon them fiercely from every side, their light canoes carrying them through shoals which the brigantines could not approach. In vain did Cortes attempt to stop and rally his flying troops; fear rendered them regardless of his intreaties or commands. Finding all his endeavours to renew the combat fruitless, his next care was to save some of them who had thrown themselves into the water; but while thus employed, with more attention to their situation than to his own, six Mexican captains suddenly laid hold of him, and were hurrying him off in triumph; and tho' two of his officers rescued him at the expence of their own lives, he received several dangerous wounds before he could break loose. Above 60 Spaniards perished in the rout; and what rendered the disaster more afflicting, 40 of these fell alive into the hands of an enemy never known to shew mercy to a captive.

131 Cortes repulsed in an attack.

The approach of night, though it delivered the dejected Spaniards from the attacks of the enemy, ushered in, what was hardly less grievous, the noise of their barbarous triumph, and of the horrid festival with which they celebrated their victory. Every quarter of the city was illuminated; the great temple shone with such peculiar splendor, that the Spaniards could plainly see the people in motion, and the priests busy in hastening the preparations for the death of the prisoners. Through the gloom they fancied that they discerned their companions by the whiteness of their skins, as they were stripped naked and compelled to dance before the image of the god to whom they were to be offered. They heard the shrieks of those who were sacrificed, and thought they could distinguish each unhappy victim by the well-known sound of his voice. Imagination added to what they really saw or heard, and augmented its horror. The most unfeeling melted into tears of compassion, and the stoutest heart trembled at the dreadful spectacle which they beheld.

Cortes, who, besides all that he felt in common with his soldiers, was oppressed with the additional load of anxious reflections natural to a general on such an unexpected calamity, could not like them relieve his mind by giving vent to its anguish. He was obliged to assume an air of tranquillity in order to revive the spirits and

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and hopes of his followers. The juncture, indeed, required an extraordinary exertion of fortitude. The Mexicans, elated with their victory, sallied out next morning to attack him in his quarters. But they did not rely on the efforts of their own arms alone; they sent the heads of the Spaniards whom they had sacrificed to the leading men in the adjacent provinces, and assured them that the god of war appeased by the blood of their invaders, which had been shed so plentifully on his altars, had declared with an audible voice, that in eight days time those hated enemies should be finally destroyed, and peace and prosperity re-established in the empire.

132 The Mexicans renew the attack with great fury.

A prediction, uttered with such confidence, and in terms so void of ambiguity, gained universal credit among a people prone to superstition. The zeal of the provinces which had already declared against the Spaniards augmented, and several which had hitherto remained inactive took arms with enthusiastic ardour to execute the decrees of the gods. The Indian auxiliaries who had joined Cortes, accustomed to venerate the same deities with the Mexicans, and to receive the responses of their priests with the same implicit faith, abandoned the Spaniards as a race of men devoted to certain destruction. Even the fidelity of the Tlascalans was shaken, and the Spanish troops were left almost alone in their stations. Cortes, finding that he attempted in vain to dispel the superstitious fears of his confederates by argument, took advantage, from the imprudence of those who had framed the prophecy in fixing its accomplishment so near at hand, to give them a striking demonstration of its falsity. He suspended all military operations during the period marked out by the oracle. Under cover of the brigantines, which kept the army at a distance, his troops lay in safety and the fatal term expired without any disaster.

His allies, ashamed of their own credulity, returned to their station. Other tribes, judging that the gods, who had now deceived the Mexicans, had decreed finally to withdraw their protection from them, joined his standard; and such was the levity of a simple people, moved by every slight impression, that, in a short time after such a general defection of his confederates, Cortes saw himself, if we may believe his own account, at the head of 150,000 Indians. Even with such a numerous army, he found it necessary to adopt a new and more wary system of operation. Instead of renewing his attempts to become master of the city at once, by such bold but dangerous efforts of valour as he had already tried, he made his advances gradually, and with every possible precaution against exposing his men to any calamity similar to that which they still bewailed. As the Spaniards pushed forward, the Indians regularly repaired the causeways behind them. As soon as they got possession of any part of the town the houses were instantly levelled with the ground. Day by day, the Mexicans, forced to retire as their enemies gained ground, were hemmed in within more narrow limits. Guatimozin, though unable to stop the career of the enemy, continued to defend his capital with obstinate resolution, and disputed every inch of ground. But the Spaniards, having not only varied their mode of attack, but, by order of Cortes, having changed the weapons with which they fought, were again armed with the long Chinantlan spears, which they had employed with such success against Narvaez; and, by the firm array in which this enabled them to range themselves, they repelled, with little danger, the loose assault of the Mexicans: incredible numbers of them fell in the conflicts, which they renewed every day. While war wasted without, famine began to consume them within the city. The Spanish brigantines, having the entire command of the lake, rendered it impossible to receive any supply of provisions by water. The vast number of his Indian auxilaries enabled Cortes to shut up the avenues, to the city by land. The stores which Guatimozin had laid up were exhausted by the multitudes which crowded into the capital to defend their sovereign and the temples of their gods. Not only the people, but persons of the highest rank, felt the utmost distresses of want What they suffered brought on infectious and mortal distempers, the last calamity that visits besieged cities, and which filled up the measure of their woes.

133 Cortes adopts a more cautious mode of proceeding.

But, under the pressure of so many and such various evils, the spirit of Guatimozin remained firm and unsubdued. He rejected with scorn every overture of peace from Cortes; and, disdaining the idea of submitting to the oppressors of his country, determined not to survive its ruin. The Spaniards continued their progress. At length all the three divisions penetrated into the great square in the centre of the city, and made a secure lodgment there. Three-fourths of the city were now reduced, and laid in ruins. The remaining quarter was so closely pressed, that it could not long withstand assailants who attacked it from their new station with superior advantage, and more assured expectation of success. The Mexican nobles, solicitous to save the life of a monarch whom they revered, prevailed on Guatimozin to retire from a place where resistance was now vain, that he might rouse the more distant provinces of the empire to arms, and maintain there a more successful struggle with the public enemy. In order to facilitate the execution of this measure, they endeavoured to amuse Cortes with overtures of submission, that while his attention was employed in adjusting the articles of pacification, Guatimozin might escape unperceived. But they made this attempt upon a leader of greater sagacity and discernment than to be deceived by their arts. Cortes suspecting their intention, and aware of what moment it was to defeat it, appointed Sandoval, the officer on whose vigilance he could most perfectly rely, to take the command of the brigantines, with strict injunctions to watch every motion of the enemy. Sandoval, attentive to the charge, observing some large canoes crowded with people rowing along the lake with extraordinary rapidity, instantly gave the signal to chace. Gracia Holguin, who commanded the fleetest brigantine, soon overtook them, and was preparing to fire on the foremost canoe, which seemed to carry some person whom all the rest followed and obeyed. At once the rowers dropt their oars, and all on board, throwing down their arms, conjured him with cries and tears to forbear, as the emperor was there. Holguin eagerly seized his prize: and Guatimozin, with a dignified composure, gave himself up into his hands, requesting only that no insult might be offered to the empress or his children. When conducted to Cortes, he

134 Guatimozin refuses to submit on any terms.

135 He is taken prisoner.

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he appeared neither with the sullen fierceness of a barbarian, nor with the dejection of a supplicant. "I have done," said he, addressing himself to the Spanish general, "what became a monarch. I have defended my people to the last extremity. Nothing now remains but to die. Take this dagger," laying his hand on one which Cortes wore, "plant it in my breast, and put an end to a life which can no longer be of use."

136 Mexico submits.

As soon as the fate of their sovereign was known, the resistance of the Mexicans ceased; and Cortes took possession of that small part of the capital which yet remained undestroyed. Thus terminated the siege of Mexico, the most memorable event in the conquest of America. It continued 75 days, hardly one of which passed without some extraordinary effort of one party in the attack, or of the other in the defence of a city, on the fate of which both knew that the fortune of the empire depended. As the struggle here was more obstinate, it was likewise more equal, than any between the inhabitants of the Old and New Worlds. The great abilities of Guatimozin, the number of his troops, the peculiar situation of his capital, so far counterbalanced the superiority of the Spaniards in arms and discipline, that they must have relinquished the enterprise, if they had trusted for success to themselves alone. But Mexico was overturned by the jealousy of neighbours who dreaded its power, and by the revolt of subjects impatient to shake off its yoke. By their effectual aid, Cortes was enabled to accomplish what, without such support, he would hardly have ventured to attempt. How much soever this account of the reduction of Mexico may detract, on the one hand, from the marvellous relations of some Spanish writers, by ascribing that to simple and obvious causes which they attribute to the romantic valour of their countrymen, it adds, on the other, to the merit and abilities of Cortes, who under every disadvantage, acquired such an ascendant over unknown nations, as to render them instruments towards carrying his scheme into execution.

The exultation of the Spaniards, on accomplishing this arduous enterprise, was at first excessive. But this was quickly damped by the cruel disappointment of those sanguine hopes which had animated them amidst so many hardships and dangers. Instead of the inexhaustible wealth which they expected from becoming masters of Montezuma's treasures, and the ornaments of so many temples, their rapaciousness could collect only an inconsiderable booty amidst ruins and desolation (A). Guatimozin, aware of his impending fate, had ordered what remained of the riches amassed by his ancestors to be thrown into the lake. The Indian auxiliaries, while the Spaniards were engaged in conflict with the enemy, had carried off the most valuable part of the spoil. The sum to be divided among the conquerors was so small, that many of them disdained to accept of the pittance which fell to their share, and all murmured and exclaimed; some against Cortes and his confidents, whom they suspected of having secretly appropriated to their own use a large portion of the riches which should have been brought into the common stock; others against Guatimozin, whom they accused of obstinacy, in refusing to discover the place where he had hidden his treasure.

Arguments, intreaties, and promises, were employed in order to soothe them; but with so little effect, that Cortes, from solicitude to check this growing spirit of discontent, gave way to a deed which stained the glory of all his great actions. Without regarding the former dignity of Guatimozin, or feeling any reverence for those virtues which he had displayed, he subjected the unhappy monarch, together with his chief favourite, to torture, in order to force from them a discovery of the royal treasures, which it was supposed they had concealed. Guatimozin bore whatever the refined cruelty of his tormentors could inflict, with the invincible fortitude of an American warrior. His fellow-sufferer, overcome by the violence of the anguish, turned a dejected eye towards his master, which seemed to implore his permission to reveal all that he knew. But the high-spirited prince, darting on him a look of authority mingled with scorn, checked his weakness, by asking, "Am I now reposing on a bed of flowers?" Overawed by a reproach, he persevered in his dutiful silence, and expired. Cortes, ashamed of a scene so horrid, rescued the royal victim from the hands of his tortures, and prolonged a life reserved for new indignities and sufferings.

137 Guatimozin tortured.

138 The Spaniards become masters of the whole Mexican empire.

The fate of the capital, as both parties had foreseen, decided that of the empire. The provinces submitted one after another to the conquerors. Small detachments of Spaniards marching through them without interruption, penetrated, in different quarters, to the great Southern Ocean, which, according to the ideas of Columbus, they imagined would open a short as well as easy passage to the East Indies, and secure to the crown of Castile all the envied wealth of those fertile regions; and the active mind of Cortes began already to form schemes for attempting this important discovery. In his after schemes, however, he was disappointed; but Mexico hath ever since remained in the hands of the Spaniards.

139 Ancient divisions of Mexico.

The *ancient* kingdom of Mexico, properly so called, was divided into several provinces, of which the vale of Mexico was the finest in every respect. It is surrounded by verdant mountains, measuring upwards of 120 miles in circumference at their base. A great part of this vale is occupied by two lakes, the upper one of fresh water, but the lower one brackish, communicating with the former by means of a canal. All the water running from the mountains is collected in this lower lake, on account of its being in the bottom of the valley; hence it was ready, when swelled by extraordinary rains, to overflow the city of Mexico, as has already been observed. This delightful region contained the three imperial cities of Mexico, Acolhuacan, and Tlacopan; besides 40 others, with innumerable villages and hamlets; but the most considerable of these, according to Clavigero, now scarcely retain one-twentieth part of their former magnificence. The principal inland provinces to the northward were the

(A) The gold and silver, according to Cortes, amounted only to 120,000 pesos, Relat. 280, A, a sum far inferior to that which the Spaniards had formerly divided in Mexico.

Mexico. the Otomies; to the south-west the Malatzincas and Cuitlatecas; to the south the Tlahuicas and Cohuixcas; to the south-east, after the states of Itzocan, Jauhtepac, Quauhquecollon, Atlixco, Tehuacan, and others, where the great provinces of the Mixtecas, the Zapotecas, and the Chiapanecas; towards the east were the provinces of Tepayacac, the Popolocas, and Totonacas. The maritime provinces on the Mexican Gulf were Coatzacualco and Cuetlachtlan, called by the Spaniards *Cotasta*. On the pacific Ocean were those of Coliman, Zacatollan, Tototepec, Tecuantepec, and Zoconochco.

The province of the Otomies began in the northern part of the vale of Mexico, extending through the mountains to the north to the distance of 90 miles from the city of Mexico; the principal cities being Tollon or Tula, and Xilotepec: the latter made the capital of the country by the Spaniards. Beyond the settlements of the Otomies, the country for more than a thousand miles in extent was inhabited only by barbarous and wandering savages.

The Malatzinca province contained the valley of Tolocan, and all the country from *Taximaroa* to the frontier of the kingdom of Michuacan. The valley of Tolocan is upwards of 40 miles long from south-east to north-west, and 30 in breadth where broadest. Its principal city, named also *Tolocan*, is situated at the foot of a high mountain covered with snow, 30 miles distant from Mexico.

The country of the Cuitlatecas extended from north-east to southwest, upwards of 200 miles, extending as far as the Pacific Ocean. Their capital was named Mexcaltepec, once a great and populous city, situated upon the sea-coast; but of which the ruins are now scarcely visible. That of the Tlahuicas was named Quauhnahuac, and situated about 40 miles to the southward of Mexico. The province extended almost 60 miles southward, commencing from the southern mountains of the vale of Mexico.

The country of the Cohuixcas extended on the southward as far as the Pacific Ocean, through that part where at present the port and city of Acapulco lie. It was divided into the states of Tzompanco, Chilapan, Tlapan, and Tistla; the latter a very hot and unwholesome country. To this province belonged a place named *Tlacho*, celebrated for its silver-mines.

The province of the Mixtecas extended from *Acatlan*, a place distant about 120 miles from Mexico, as far as the Pacific Ocean towards the south-east. The inhabitants carried on a considerable commerce, and had several well inhabited cities and villages. To the east of the Mixtecas were the Zapotecas, so called from their capital Teotzapotlan. In their district was the valley of Huaxyacac, now Oaxaca or Guaxaca.

The province of Mazatlan lay to the northward of the Mixtecas; and to the northward and eastward of the Zapotecas was *Chimantla*, having their capitals of the same name with their provinces. The Chiapanecas, Zoqui, and Queleni, were the last of the Mexican provinces towards the south-east. On the side of the mountain Popocatepec and around it lay several states, of which the most considerable were Cholallan and Huexotzinco. Those two having, with the assistance of the Tlascalans, shaken off the Mexican yoke, re-established their former aristocratical government. The Cholulans possessed a small hamlet called Cuitlaxcoapan, in the place where the Spaniards afterwards founded the city of Angelopoli, which is the second of New Spain.

To the eastward of Cholula lay a considerable state named Tepayacac; and beyond that the Popolocas, whose principal cities were Tecamachalco and Quecholac. To the southward of the Popolocas was the state of Tahuacan, bordering upon the country of the Mixtecas; to the east, the maritime province of Cuetlachtlan; and to the north the Totonacas. The extent of this province was 150 miles, beginning from the frontier of Zacatlan, a state distant about 80 miles from the court, and terminating in the Gulf of Mexico. Besides the capital, named *Mizquihuacan*, this country had the beautiful city of Chempoallan, situated on the coast of the Gulf; remarkable for being that by which the Spaniards entered the Mexican empire.

Coliman was the most northerly of the provinces on the Pacific Ocean; the capital, named also Coliman, being in lat. 19. long. 272. Towards the south-east was the province of Zacotlan, with its capital of the same name; then came the coast of the Cuitlatecas; after it that of the Cohuixcans, in which was the celebrated port of Acapulco. The *Jopi* bordered on the Cohuixca coast; and adjoining to that the Mixteca country, now called *Xicayan;* next to that was the large province of Tecuantepec; and lastly, that of Xochonochco.

This province, the most southerly of the Mexican empire, was bounded on the east and south-east by the country of Xochitepec, which did not belong to Mexico; on the west by Tecuantepec; and on the south by the ocean. The capital, called also *Xoconochco*, was situated between two rivers, in 14 degrees of latitude and 283 of longitude. On the Mexican Gulph there were, besides the country of the Totonecas, the provinces of Cuetlachtlan and Coatzacualco; the latter bounded on the east by the states of Tabasco and the peninsula of Yucatan. The province of Cuetlachtlan comprehended all the coast between the rivers Alvarado and Antigua, where the province of the Totonecas began.

140 Climate. The climate of this vast country varies very much according to the situation of its different parts. The maritime places are hot, unhealthy, and moist; the heat being so great as to cause people sweat even in the month of January. This heat is supposed to be owing to the flatness of the coasts, and the accumulation of sand upon them. The moisture arises from the vast evaporation from the sea, as well as from the great torrents of water descending from the mountains. The lands which lie in the neighbourhood of high mountains, the tops of which are always covered with snow, must of necessity be cold; and Clavigero informs us, that he has been on a mountain not more than 25 miles distant from the city of Mexico, where there was white frost and ice even in the dog-days. "All the other inland countries (says our author), where the greatest population prevailed, enjoys a climate so mild and benign, that they neither feel the rigour of winter nor the heats of summer. It is true, in many of these countries, there is frequently white frost in

Mexico.

in the three months of December, January, and February, and sometimes even it snows; but the small inconvenience which such cold occasions continues only till the rising sun; no other fire than his rays is necessary to give warmth in winter; no other relief is wanted in the season of heat but the shade: the same clothing which covers men in the dog-days defends them in January, and the animals sleep all the year under the sky.

141 Causes of mildness of the climate.

"This mildness and agreeableness of climate under the torrid zone is the effect of several natural causes entirely unknown to the ancients, who did not believe it to be inhabited; and not well understood by some moderns, by whom it is believed unfavourable to those who live in it. The purity of the atmosphere, the smaller obliquity of the solar rays, and the longer stay of this luminary above the horizon in winter, in comparison of other regions farther removed from the equator, concur to lessen the cold, and to prevent all that horror which disfigures the face of nature in other climes. During that season a serene sky and the natural delights of the country are enjoyed; whereas, under the frigid, and even for the most part under the temperate zones, the clouds rob man of the prospect of heaven, and the snow buries the beautiful productions of the earth. No less causes combine to temper the heat of summer. The plentiful showers which frequently water the earth after mid-day from April or May to September or October; the high mountains, continually loaded with snow, scattered here and there through the country of Anahuac; the cool winds which breathe from them in that season; and the shorter stay of the sun above the horizon, compared with the circumstances of the temperate zone, transform the climes of those happy countries into a cool and cheerful spring. But the agreeableness of the climate is counterbalanced by thunder-storms, which are frequent in summer particularly in the neighbourhood of the mountain of Tlascala; and by earthquakes, which are at all times felt, though with less danger than terror. Storms of hail are neither more frequent nor more severe than in Europe."

142 Mexican volcanoes.

One undoubted inconvenience which Mexico has is that of volcanoes, of which our author enumerates five. One named by the Spaniards *Volcan d'Orizaba* is higher than the peak of Teneriffe, according to the account of the Jesuit Tallandier, who measured them both. It began to send forth smoke in the year 1545, and continued burning for 20 years, but has not discovered any symptoms of eruption since that time. It is of a conical figure; and by reason of its great height, may be seen at 50 leagues distance. The top is always covered with snow, but the lower part with woods of pine and other valuable timber. It is about 90 miles to the eastward of the capital.

Two other mountains, named *Popocatopec* and *Iztaccihuatl*, which lie near each other, at the distance of 33 miles to the south-east of Mexico, are likewise surprisingly high. Clavigero supposes the former to be higher than the highest of the Alps, considering the elevated ground on which the base of it stands. It has a crater more than half a mile wide: from which, in the time of the Mexican kings, great quantities of smoke and flame issued. In the last century it frequently threw out great showers of ashes upon the adjacent places; but in this century hardly any smoke has been observed. This mountain is named by the Spaniards *Volcan*, and the other *Sierra Nevada*. The latter has also sometimes emitted flames. Both of them have their tops always covered with snow in such quantities, that the masses which fall down upon the neighbouring rocks supply the cities of Mexico, Gelopoli, Cholula, and all the adjacent country to the distance of 40 miles, with that commodity; of which the consumpt is so great, that in 1746 the impost upon what was consumed in the city of Mexico amounted to 15,222 Mexican crowns; some years after it amounted to 20,000; and is now in all probability a great deal more. Besides these, there are the two mountains of Coliman and Tochtlan, both of which have occasionally emitted flames. Our author does not include in the list of Mexican volcanoes either those of Nicaragua or Guatimala; because these countries were not subject to the Mexican sovereigns. Those of Guatimala sometimes break forth in a most furious manner, and in the year 1773 entirely destroyed that beautiful city. The Nicaraguan volcano called *Juruyo* was only a small hill before the year 1760. In that year, however, on the 29th of September, it began to burn with furious explosions, ruining entirely the sugar-work and the neighbouring village of *Guacana*; and from that time continued to emit fire and burning rocks in such quantities, that the erupted matters in six years had formed themselves into three high mountains nearly six miles in circumference. During the time of the first eruption, the ashes were carried as far as the city of Queretaro, 150 miles distant from the volcano; and at Valladolid, distant 60 miles from it, the shower was so abundant, that the people were obliged to sweep the house-yards two or three times a-day.

Besides these volcanoes, there are others in Mexico of a very remarkable height. The great chain of mountains called the *Andes* are continued through the isthmus of Panama and through all Mexico, until they are lost in the unknown mountains of the north. The most considerable of that chain is known in Mexico, by the name of *Sierra Madre* particularly in Cinaloa and Tarahumara, provinces no less than 1200 miles distant from the capital.

143 Rivers and lakes.

Mexico is well watered by very considerable rivers though none of them are comparable to those of South America. Some of those run into the gulf of Mexico and others into the pacific Ocean. The Alvarado has its principal source among the mountains of the Zapotecas, and discharges itself by three navigable mouths into the Mexican gulf, at the distance of 30 miles from Vera Cruz. The Coatzocualco rises among the mountains of the Mixtecas, and empties itself into the gulf near the country of Onohualco. The river Chiapan, which likewise runs into this gulf, rises among the mountains which separate the district of Chiapan from that of Guatimala. The Spaniards call this river *Tabasco*; by which name they also called that tract of land which unites Yucatan to the Mexican continent. It was also called the *Grigalva*, from the name of the commander of the first Spanish fleet who discovered it.

The most celebrated of the rivers which run into the Pacific Ocean is that called by the Spaniards

Gau-

Mexico. *Gaudalaxara* or *Great river*. It rises in the mountains of Toloccan; and after running a course of more than 600 miles, discharges itself into the ocean in 22° latitude.

There are likewise in this country several lakes of very considerable magnitude: but those of Nicaragua, Chapallan, and Pazquaro, which are of the greatest extent, did not belong to the ancient Mexican empire. The most remarkable were those in the vale of Mexico, upon which the capital of the empire was founded. Of these, the fresh water one called the *lake of Chalco*, extended in length from east to west 12 miles, as far as the city of Xochimileo; from thence, taking a northerly direction, it incorporated itself by means of a canal with the lake of Tezcuco; but its breadth did not exceed six miles. The other, named the *lake of Tezcuco*, extended 15, or rather 17, miles from east to west, and something more from south to north; but its extent is now much less, by reason of the Spaniards having diverted the course of many of the streams which run into it. This lake is salt, which Clavigero supposes to arise from the nature of the soil which forms its bed.

Besides these, there are a number of smaller lakes, some of which are very delightful. There is a vast variety of mineral waters, of the nitrous, sulphureous, and aluminous kinds, some of them so hot that meat might be boiled in them. At Tetuhuacan is a kind of petrefying water, as well as in several other parts of the empire. One of them forms a kind of smooth white stones not displeasing to the taste; the scrapings of which taken in broth are celebrated as a diaphoretic, probably without any good reason. The dose for a person not difficult to be sweated is one drachm of the scrapings. Many of the rivers of Mexico afford surprising and beautiful cascades; particularly the great river Guadalaxara, at a place called *Tempizque*, 15 miles to the southward of that city. Along a deep river called *Atoyaque* is a natural bridge consisting of a vast mound of earth, along which carriages pass conveniently. Clavigero supposes it to have been the fragment of a mountain thrown down by an earthquake, and then penetrated by the river.

144 Metals and minerals. The mineral productions of Mexico are very valuable. The natives found gold in several provinces of the empire. They gathered it principally from among the sands of their rivers in grains; and the people in whose country it was found, were obliged to pay a certain quantity by way of tribute to the emperor. They dug silver out of mines in Tlochco, and some other countries but it was less prized by them than by other nations. Since the conquests however, so many silver mines have been discovered in that country, especially in the provinces to the northwest of the capital, that it is in vain to attempt any enumeration of them. They had two sorts of copper; one hard, which served them instead of iron, to make axes and other instruments for war and agriculture; the other kind, which was soft and flexible, served for domestic utensils as with us. They had also tin from the mines of Tlachco, and dug lead out of mines in the country of the Otomies; but we are not informed what uses they put this last metal to. They had likewise mines of iron in Tlascala, Tlacho, and some other places; but these were either unknown to the Mexicans, or they did not know how to benefit themselves by them. In Chilapan were mines of quicksilver; and in many places they had sulphur, alum vitriol, cinnabar ochre, and an earth greatly resembling white lead. These minerals were employed in painting and dyeing: but we know not to what use they put their quicksilver. There was great abundance of amber and asphaltum upon their coasts; both of which were paid in tribute to the king of Mexico from many parts of the empire. The former was wont to be set in gold by way of ornament, and asphaltum was employed in their sacrifices.

145 Precious stones. Mexico produces some diamonds, though but few in number; but they had in greater plenty some other precious stones, such as amethysts, cats-eyes, turquoises, cornelians, and some green stones resembling emeralds, and very little inferior to them; of all which a tribute was paid to the emperor by the people in whose territories they were found. They were likewise furnished with crystal in plenty from the mountains which lay on the coast of the Mexican gulph, between the port of Vera Cruz and the river Coatzacualco. In the mountains of Celpolalpan, to the eastward of Mexico, were quarries of jasper and marble of different colours: they had likewise alabaster at a place called *Tecalco*, now *Tecale*, in the neighbourhood of the province of Tapeyacac and many other parts of the empire. The stone tetzontli is generally of a dark red colour, pretty hard, porous and light, and unites most firmly with lime and sand; on which account it is of great request for buildings in the capital, where the foundation is bad. There are entire mountains of loadstone, a very considerable one of which lies between Teoitztlan and Chilapan, in the country of the Cohuixcas. They formed curious figures of nephritic stone, some of which are still preserved in European museums. They had a kind of fine white talc which burnt into an excellent plaster, and with which they used to whiten their paintings. But the most useful stone they had was that called *itztli*, of which there is great abundance in many parts of Mexico. It has a glossy appearance, is generally of a black colour, and semitransparent; though sometimes also of a blue or white colour. In South America this stone is called *pietra del galinazzo*; and Count Caylus endeavours to show, in a manuscript dissertation quoted by Bomare, that the *obsidiona*, of which the ancients made their *vases murini*, were entirely similar to this stone. The Mexicans made of it looking-glasses, knives, lancets, razors, and spears. Sacred vases also were made of it after the introduction of Christianity.

146 Vegetable productions. The soil of Mexico, though various, produced every where the necessaries and even the luxuries of life. "The celebrated Dr Hernandez, the Pliny of New Spain (says Clavigero), has described in his Natural History about 1200 plants natives of the country; but this description, though large being confined to medicinal plants, has only comprised one part of what provident nature has produced there for the benefit of mortals. With regard to the other classes of vegetables, some are esteemed for their flowers, some for their fruit, some for their leaves, some for their root, some for their trunk or their wood; and others for their gum, resin, oil, or juice."

Mexico

Mexico.

147 Flowers and fruits.

Mexico abounds with a great variety of flowers, many of which are peculiar to the country, while multitudes of others imported from Europe and Asia rival in luxuriance the natives of the country itself. The fruits are partly natives of the Canary islands, partly of Spain, besides those which grow naturally in the country. The exotics are water-melons, apples, pears, peaches, quinces, apricots, pomegranates, figs, black cherries, walnuts, almonds, olives, chesnuts, and grapes; though these last are likewise natives. There are two kinds of wild vine found in the country of the Mixtecas; the one resembling the common vine in the shoots and figure of its leaves. It produces large red grapes covered with an hard skin, but of sweet and grateful taste, which would undoubtedly improve greatly by culture. The grape of the other kind is hard, large, and of a very harsh taste, but they make an excellent conserve of it. Our author is of opinion that the cocoa tree, plantain, citron, orange, and lemon, came from the Philippine islands and Canaries; but it is certain that these, as well as other trees, thrive in this country as well as in their native soil. All the maritime countries abound with cocoa-nut trees; they have seven kinds of oranges and four of lemons, and there are likewise four kinds of plantains. The largest, called the *zapalat*, is from 15 to 20 inches long, and about three in diameter; it is hard, little esteemed, and only eat when roasted or boiled. The *platano largo*, or "long plantain," is about eight inches long and one and a half in diameter: the skin is at first green, and blackish when perfectly ripe. The *guinco* is a smaller fruit, but richer, softer, and more delicious, though not so wholesome. A species of plantain, called the *dominico*, is smaller and more delicate than the others. There are whole woods of plantain trees, oranges, and lemons; and the people of Michuacan carry on a considerable commerce with the dried plantains, which are preferable either to raisins or figs. Clavigero enumerates 28 different sorts of fruit natives of Mexico, besides many others, the names of which are not mentioned. Hernandez mentions four kinds of cocoa nuts; of which the smallest of the whole was in most use for chocolate and other drinks daily made use of; the other kinds served rather for money in commerce than for aliment. The cocoa was one of the plants most cultivated in the warm countries of the empire; and many provinces paid it in tribute to the emperor, particularly that of Xoconocho, the cocoa nut of which is preferable to the others. Cotton was one of the most valuable productions of the country as it served instead of flax; though this last also was produced in the country. It is of two kinds, white and tawny-coloured. They made use of *rocou* or Brasil-wood in their dying, as the Europeans also do. They made cordage of the bark, and the wood was made use of to produce fire by friction.

148 Grain.

The principal grain of Mexico, before the introduction of those from Europe, was maize, in the Mexican language called *tlaolli*; of which there were several kinds, differing in size, weight, colour, and taste. This kind of grain was brought from America to Spain, and from Spain to the other countries of Europe. The French bean was the principal kind of pulse in use among them, of which there were more species than of the maize. The largest was called *ayacotli*, of the size of a common bean, with a beautiful red flower; but the most esteemed was the small black, heavy, French bean. This kind of pulse, which is not good in Italy, is in Mexico so excellent, that it not only serves for sustenance to the poorer class of people, but is esteemed a luxury even by the Spanish nobility.

149 Esculent roots.

Of the esculent roots of Mexico, the following were the most remarkable. 1. The *xicama*, called by the Mexicans *catzotl*, was of the figure and size of an onion; solid, fresh, juicy, and of a white colour; it was always eat raw. 2. The *camote*, is another very common in the country, of which there are three sorts, white, yellow, and purple: they eat best when boiled. 3. The *cacomite* is the root of a plant which has a beautiful flower called the *tyger-flower*, with three red pointed petals, the middle part mixed with white and yellow, somewhat resembling the spots of the creature whence it takes its name. 4. The *huacamote*, is the root of a kind of Cassava plant, and is likewise boiled. 5. The *papa*, a root transplanted into Europe, and greatly valued in Ireland, was brought from South America into Mexico. Besides all which they have a number of kitchen vegetables imported from the Canaries, Spain, and other countries of Europe. The American aloe is very similar to the real one, and is a plant of which the Mexicans formerly, and the Spaniards still, make great use.

150 Trees.

They have a variety of palm-trees. From the fibres of the leaves of one species they make thread. The bark of another kind, to the depth of three fingers, is a mass of membranes, of which the poor people make mats. The leaves of another kind are used for ornaments in their festivals. They are round, gross, white, and shining; having the appearance of shells heaped upon one another. A fourth kind bears nuts called *cocoas*, or nuts of oil. These nuts are of the size of a nutmeg, having in the inside a white, oily, eatable kernel, covered by a thin, purple pellicle. The oil has a sweet scent, but is easily condensed, when it becomes a soft mass, as white as snow.

Of timber trees there are a great variety, of a quality not inferior to any in the world; and as there are a variety of climates in the country, every one produces a kind of wood peculiar to itself. There are whole woods of cedars and ebonies, vast quantities of algalochum or wood of aloes; besides others valuable on account of their weight, durability, and hardness; or for their being easily cut, pliable, of a fine colour, or an agreeable flavour. There are also in Mexico innumerable trees remarkable for their size. Acosta mentions a cedar, the trunk of which was 16 fathoms in circumference; and Clavigero mentions one of the length of 107 Paris feet. In the city of Mexico he mentions very large tables of cedar made out of single planks. In the valley of Atlixco is a very ancient fir-tree, hollowed by lightning; the cavity of which could conveniently hold fourteen horsemen; nay, we are informed by the archbishop of Toledo, that, in 1770, he went to view it along with the archbishop of Guatimala, at which time he caused an hundred young lads enter its cavity. Our author mentions some other trees, of the species called *ceibas*, which for magnitude may be compared with this celebrated

Mexico. lebrated ſir. "The largeneſs of theſe trees (ſays he) is proportioned to their prodigious elevation; and they afford a moſt delightful proſpect at the time they are adorned with new leaves and loaded with fruit, in which there is incloſed a particular ſpecies of fine, white, and moſt delicate cotton. This might be, and actually has been, made into webs as ſoft, delicate, and perhaps more ſo than ſilk; but it is toilſome to ſpin, on account of the ſmallneſs of the threads, and the profit does not requite the labour, the web not being laſting. Some uſe it for pillows and matraſſes, which have the ſingular property of expanding enormouſly when expoſed to the heat of the ſun. De Bomare ſays, that the Africans make of the thread of the ceiba that vegetable taffety which is ſo ſcarce, and ſo much eſteemed in Europe. The ſcarcity of ſuch cloth is not to be wondered at conſidering the difficulty of making it. The ceiba, according to this author, is higher than all other trees yet known."

Clavigero mentions a Mexican tree, the wood of which is very valuable, but poiſonous, and if incautiouſly handled, when freſh cut, produces a ſwelling in the ſcrotum. Our author has forgot the name given to it by the Mexicans; nor has he ever ſeen the tree itſelf, nor been witneſs to the effect.

151 Medicinal and aromatic gums.

This country abounds alſo with aromatic and medicinal trees, producing gums, reſins, &c. From one of theſe a balſam is produced not in the leaſt inferior to the celebrated balſam of Mecca. It is of a reddiſh black or yellowiſh white, of a ſharp bitter taſte, and of a ſtrong but moſt grateful odour. It is common in the provinces of Panuco and Chiapan, and other warm countries. The kings of Mexico cauſed it to be tranſplanted into their celebrated garden of Huaxtepec, where it flouriſhed, and was afterwards multiplied in all the neighbouring mountains. The Indians, in order to procure a greater quantity of this balſam, burn the branches, which affords more than mere diſtillation though undoubtedly of an inferior quality; nor do they regard the loſs of the trees, which are very abundant. The ancient Mexicans were wont to extract it alſo by decoction. The firſt parcel of this balſam brought from Mexico to Rome was ſold at one hundred ducats per ounce; and was, by the apoſtolic ſee, declared to be matter fit for chriſm; though different from that of Mecca, as Acoſta and all other writers on this ſubject obſerve. An oil is likewiſe drawn from the fruit of this tree, ſimilar in taſte and ſmell to that of the bitter almond, but more acrimonious. From two other trees named the *huaconex* and *maripenda*, an oil was extracted equivalent to the balſam. The former is a tree of a moderate height; the wood of which is aromatic, and ſo hard, that it will keep freſh for ſeveral years, though buried under the earth. The leaves are ſmall and yellow; the flowers likewiſe ſmall and white, and the fruit ſimilar to that of the laurel. The oil was diſtilled from the bark of the tree, after breaking it, and keeping it three days in ſpring-water, and then drying it in the ſun. The leaves likewiſe afforded an agreeable oil by diſtillation. The Maripenda is a ſhrub with lanceolated leaves the fruit of a red colour when ripe, and reſembling the grape. The oil is extracted by boiling the branches with a mixture of ſome of the fruit.

The tree producing liquid amber, the liquid ſtorax of the Mexicans, is of a large ſize, the leaves ſimilar to thoſe of the maple, indented, white in one part and dark in the other, diſpoſed of in threes; the fruit is thorny and round, but polygonous, with the ſurface and the angles yellow; the bark of the tree partly green and partly tawny. By inciſions in the trunk they extract that valuable ſubſtance named *liquid amber*, and the oil of the ſame name, which is ſtill more valuable. Liquid amber is likewiſe obtained from a decoction of the branches, but it is inferior to that obtained from the trunk. Mexico.

The name *copalli* in Mexico is generic, and common to all the reſins; but eſpecially ſignifies thoſe made uſe of for incenſe. There are ten ſpecies of theſe trees yielding reſins of this kind; the principal of which is that from which the COPAL is got, ſo well known in medicine and varniſhes. A great quantity of this was made uſe of by the ancient Mexicans, and is ſtill uſed for ſimilar purpoſes by the Spaniards. The *tecopalli* or *tepecopalli* is a reſin ſimilar to the incenſe of Arabia; which diſtils from a tree of moderate ſize that grows in the mountains, having a fruit like an acorn, and containing the nut inveloped in a mucilage, within which there is a ſmall kernel uſeful in medicine.

The *mizquitl*, or mezquite, is a ſpecies of true acacia, and the gum diſtilling from it is ſaid to be the true gum arabic. It is a thorny ſhrub, with branches irregularly diſpoſed, the leaves ſmall, thin, and pinnated; the flowers being like thoſe of the birch-tree.—The fruits are ſweet and eatable, containing a ſeed of which the barbarous Chichemecas were wont to make a kind of paſte that ſerved them for bread. The wood is exceedingly hard and heavy, and the trees are as common in Mexico as oaks are in Europe, particularly on hills in the temperate countries.

Of the elaſtic gum, which is found in plenty in Mexico, the natives were in uſe to make foot-balls, which, though heavy, have a better ſpring than thoſe filled with air. At preſent they varniſh with it their hats, cloaks, boots, and great coats, in a manner ſimilar to what is done in Europe with wax; and by which means they are rendered all water-proof.

152 Mexican animals.

Our author laments that the natural hiſtory of vegetables in Mexico is very little known, and that of animals no better. The firſt Spaniards (ſays he) who gave them names, were more ſkilful in the art of war than in the ſtudy of nature. Inſtead of retaining the terms which would have been moſt proper, they denominated many animals tygers, wolves, bears dogs, ſquirrels &c. although they were very different in kind, merely from ſome reſemblance in the colour of their ſkin, their figure, or ſome ſimilarity in habits and diſpoſition. The quadrupeds found in Mexico at the arrival of the Spaniards, were lions, tygers, wild cats, bears, wolves, foxes, the common ſtags, white ſtags, bucks, wild goats, badgers, pole-cats, weaſles, martins, ſquirrels, polatucas, rabbits hares, otters, and rats. All theſe animals are ſuppoſed by our author to be common to both continents. The white ſtag, whether it be the ſame ſpecies of the other or not, is undoubtedly common to both, and was known to the Greeks and Romans. The Mexicans call it the *king of the ſtags*. M. Buffon imagines the white

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white colour of this creature to be the effect of captivity; but Clavigero says, that it is found wild, and of the same white colour, on the mountains of New Spain. In many other points, he also controverts the opinions of this celebrated naturalist, who will not allow the lion, tyger, or rabbit, to be natives of America. "The *miztli* of the Mexicans (says he) is no other than the lion without hair mentioned by Pliny, and totally distinct from the African lion; and the *ocelotl* is no way different from the African tyger, according to the testimony of Hernandez, who knew both the one and the other. The *tochtli* of Mexico is exactly the rabbit of the old continent; and at least as ancient as the Mexican calender, in which the figure of the rabbit was the first symbolical character of their years. The wild cats, in size much larger than the domestic cats, are fierce and dangerous; the bears are all black, and more corpulent than those which are brought from the Alps into Italy. The hares are distinguished from those of Europe by their longer ears, and the wolves by a grosser head. According to M. Buffon, the Mexicans give the name of *polutaca* to the quimicpaltan, or flying rat of the Mexicans. We call it rat, because it resembles a rat in the head, though it is much larger, and flying; because in its natural state, the skin of its sides is loose and wrinkled, which it distends and expands together with its feet like wings, when it makes any considerable leap from one tree to another. This is confounded with the common squirrel on account of their likeness, but they are undoubtedly different. Mice were brought to Mexico in European ships; the rats were not so, but known in the country by the name of *quimichin*, a word metaphorically applied to spies."

Our author now proceeds to enumerate the quadrupeds common to New Spain with the rest of the continent of America. Among these he will not allow a place to the Peruvian sheep, the *huanaco*, and sloth; all of which are peculiar to South America. Hernandez indeed makes mention of the Peruvian sheep, and gives a drawing of it; but this was only on account of a few individuals brought thence from Peru, which the Mexicans called by that name, in the same manner as he describes several animals of the Philippine isles; not that they had ever been bred in Mexico, or found in any country of North America, unless it was some individual carried there, as they are carried as a curiosity to Europe. The animals which he allows to be common to both countries are, the Mexican hog, the moufete, the opossum, the armadillo, the *techichi*, a small animal resembling a dog; which being perfectly dumb, gave occasion to a report that the Mexican dogs could not bark. The flesh of this animal was eat by them, and was esteemed agreeable and nourishing food. After the conquest of Mexico, the Spaniards having neither large cattle nor sheep, provided their markets with this quadruped; by which means, the species soon came to be extinct, though it had been very numerous. The land-squirrel is very numerous in the kingdom of Michuacan, has great elegance of form, and is extremely graceful in its movement; but it cannot be tamed, and bites most furiously every person who approaches it.

Besides these, there are sea-lions, rattoons, and that voracious animal named the *tapir*. Oviedo informs us, that he has seen it at one bite tear off two or three hand-breadths of skin from a hound, and, at another a whole leg and thigh. The flesh is eatable, and its skin is valued on account of its being sufficiently strong to resist musket-balls. There are likewise great numbers of monkeys of many different kinds; some of which have heads resembling those of dogs. Some of them are strong and fierce, equalling a man in stature when they stand upright.

153 Description of some animals peculiar to Mexico.

Among the animals peculiar to Mexico, is one named by our author *coyoto*, which appears to have been inaccurately described by other natural historians; some making it one species and some another. He says it has the voracity of a wolf, the cunning of a fox, the form of a dog, and in some properties resembles the *adive* and *chacal*. It is about the size of a mastiff, but more slender. The eyes are yellow and sparkling, ears small, pointed, and erect; the snout blackish, strong limbs, and the feet armed with large crooked nails. The tail is thick and hairy, the skin a mixture of black, brown, and white; and the voice is compounded of the howl of the wolf and the bark of the dog. It is one of the most common quadrupeds in Mexico, and most destructive to the flocks. When it invades a sheep-fold, if it cannot find a lamb to carry off, it seizes a sheep by the neck with its teeth, and coupling with it, and beating it on the rump with its tail, conducts it whither it pleases. It pursues the deer, and will sometimes even attack men. Its usual pace is a trot, but so quick that a horse at the gallop can scarce overtake it. The *tlalcojotl* or *tlalcoyoto* is about the size of a middling dog, and in our author's opinion is the largest animal that lives under the earth. Its head has some resemblance to that of a cat; but in colour and length of hair it resembles the lion.—It has a long thick tail, and feeds upon poultry and small animals, which it catches in the night-time. The *tepeizuintli*, or mountain-dog, though it is but of the size of a small dog, is so bold that it attacks deer, and sometimes kills them. Its hair and tail are long, the body black, but the head, neck, and breast, white. Mr Buffon reckons this animal the same with the glutton, but Clavigero denies it. Another animal, larger than the two foregoing, is called the *xoloitzcuintli*. Some of these are no less than four feet in length. It has a face like the dog, but tusks like the wolf, with erect ears, the neck gross, and the tail long.—It is entirely destitute of hair, excepting only the snout where there are some thick crooked bristles. The whole body is covered with a smooth, soft, ash-coloured skin, spotted partly with black and tawney. This species of animals, as well as the two former, are almost totally extinct. A Lyncean academician named *Giovanni Fabri*, has endeavoured to prove that the xoloitzcuintli is the same with the wolf of Mexico; but this is denied by our author.

An animal called *ocotochtli*, a kind of wild cat, is remarkable more for the fabulous account of it than for any singular property with which it is really endowed. According to Dr Hernandez, when this creature takes any prey, it covers it with leaves, and afterwards mounting on some neighbouring tree, it begins howling to invite other animals to eat its prey; being itself always the last to eat; because the poison of

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of its tongue is so strong, that if it eat first, the prey would be infected, and other animals which eat of it would die.

(153) Curious kind of mole.

A curious animal of the mole kind is called *tozan* or *tuza*. It is about the size of an European mole, but very different otherwise. The body is about seven or eight inches long, and well made; the snout like that of a mouse, the ears small and round, with the tail short. The mouth is armed with very strong teeth, and its paws are furnished with strong crooked nails, with which it digs its habitations in the earth. It is extremely destructive to the corn fields by the quantity of grain it steals, and to the highways by the number of holes it makes in them; for when, on account of the dimness of its sight, it cannot find its first hole, it makes another, and so on. It digs the earth with its claws and two canine teeth which it has in the upper jaw. In digging, it puts the earth into two membranes like purses, which are under its ear, and which are furnished with muscles necessary for contraction and distension. When the membranes are full, it empties them by striking the bottom with its paws, and then digs again as before. These creatures are very numerous; but our author does not remember to have seen them in the place where land-squirrels inhabit.

154 Mexican birds.

The birds are so numerous, and of such various appearances and qualities, that Mexico has been called the country of birds as Africa is of quadrupeds. Though Hernandez passes over a great number of species, he yet describes above 200 peculiar to the country. He allows to the eagles and hawks of Mexico a superiority over those of Europe; and the falcons of this country were formerly esteemed so excellent, that, by the desire of Philip II. an hundred of them were sent every year over to Spain. The largest, the most beautiful, and the most valuable kind of eagles, is called by the Mexicans *itzquauhtli*, and will pursue not only the larger kind of birds, but quadrupeds, and even men.

The ravens of Mexico do not, like those of other countries, feed upon carrion, but subsist entirely by stealing corn. The carrion is devoured by the birds called in South America *galinazzi*, in Mexico *zopilots* and *aure*. By Hernandez they are said to be a species of ravens; but, according to Clavigero, they are very different, not only in their size but in the shape of their head, their flight, and their voice.—They fly so high, that though pretty large, they are lost to the sight: before a hail-storm they may be seen wheeling in great numbers in the air, until they entirely disappear. They discover carrion by the acuteness of their sight and smell at a great height in the air, and descend upon it in a spiral flight. They are extremely numerous, and are very useful to the country, because they not only clear the fields of carrion but attend the crocodiles, and destroy the eggs of these terrible animals. There is another bird, called by the Mexicans the *king of the zopilots*, on account as it is said, that the true zopilot will not touch a bit of carrion till the other has first tasted it.

The aquatic birds are very numerous, and of great variety.—There are at least 20 species of ducks, a vast number of geese, with several kinds of herons, great numbers of swans, quails, water-rails, divers, king's fishers, pelicans, &c. The multitude of ducks is sometimes so great, that they cover the fields, and appear at a distance like flocks of sheep. Some of the herons and egrets are perfectly white, some ash-coloured; others have the plumage of the body white, while the neck, with the tops and upper part of the wings, and part of the tail, are enlivened with a bright scarlet, or beautiful blue. Clavigero mentions a singular quality of the pelican, in which it differs from all other birds hitherto known, viz. that it assists such of its own species as are hurt or sick. Of this disposition the Americans sometimes take the advantage to procure fish without any trouble. They take a live pelican and break its wing, and, after tying it to a tree, conceal themselves in the neighbourhood: there they watch the coming of the other pelicans with their provisions; and as soon as they see them throw up the fish from the pouch they have below their bill, they run in, and leaving a little for the captive bird carry off all the rest. The *yoalquachilli* is a small aquatic bird, with a long narrow neck, small head, long yellow bill, long legs, feet, and claws, and a short tail. It is remarkable for the weapons with which it is naturally provided. On the head is a little circle or coronet, of a horny substance, which is divided into three very sharp points, and there are two others on the fore-part of the wings.

155 Singular property of the pelican.

Numbers of the other classes of birds are valuable for their flesh, plumage, or song, while some are remarkable for their extraordinary instinct or other properties. Our author enumerates more than 70 species of those which afford an agreeable and wholesome food. Besides the common fowls which were brought from the Canaries to the Antilles, and from these to Mexico, there were, and still are, fowls peculiar to the country itself. These partly resemble the common fowl and partly the peacock, whence they had the name of *gallipavos* from the Spaniards. From Mexico, they were imported into Europe, where they have multiplied very fast, especially in Italy, though the common fowls have multiplied much more in Mexico. There are three kinds of pheasants; one of which is as large as a goose, and very docile. It will become so tame as to pick food from its master's hand, and run to meet him with signs of joy when he comes home, shut the door with its bill &c. By keeping in a yard along with other poultry, it learns to fight like a cock, raising the feathers of its crest, as cocks do those of their neck.

There are great numbers of birds valuable on account of their plumage, which was made use of by the Mexicans in their excellent mosaic works; an art which seems now to be totally lost. Peacocks have been carried from the old continent to Mexico; but, not being attended to, have propagated very slowly. The birds remarkable for their song are likewise very numerous; among which that called the *centzonitl*, by Europeans the *mocking-bird*, is the most remarkable, on account of its counterfeiting naturally the notes of all others it hears. It has been attempted to bring it to Europe, but without success. The cardinals are very remarkable, not only on account of their fine colours, but likewise of their notes; and even the sparrows have a most delightful and various song.

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There are great numbers of beautiful parrots; and there is a bird which counterfeits the human voice, but in a kind of burlesque tone, and will follow travellers a great way. The *tzacua* is remarkable for its instinct. Birds of this kind live in society, every tree being a village or city to them, having great numbers of nests in the neighbourhood of each other, all hanging from the boughs. One of them, whose office it is to be the head or guard of the village, resides in the middle of the tree; from which it flies about from one nest to another, visiting them all, and after singing a little, returns to its place, while the rest continue perfectly silent. If any bird of a different species approaches the tree, he flies to it, and with his bill and wings endeavours to drive it off; but if a man or any large animal comes near, he flies screaming to another tree; and if at that time any of his fellows happen to be returning to their nests, he meets them, and, changing his note, obliges them to retire again: as soon as he perceives the danger over, he returns to his wonted round of visiting the nests.

156 Reptiles.

Mexico, like all other American countries, abounds with reptiles, many of them of an enormous size. The crocodiles are not less to be dreaded than those of Africa or Asia; and there are likewise some of those monstrous serpents met with in the East Indies and in South America; though happily the species of those terrible creatures seems to be nearly extinct, as they are seldom to be found but in some solitary wood, or other remote place. There are great numbers of lizards, some of which the people suppose to be poisonous; but our author thinks this opinion ill founded. There are several kinds of poisonous serpents, of which the rattle-snake is one. The *cincoatl* is another poisonous serpent, and remarkable for having a luminous appearance in the dark; by which, as by the rattle in the tail of the former, travellers are warned to avoid it. Among the harmless snakes is a very beautiful one about a foot in length, and of the thickness of the little finger. It appears to take great pleasure in the society of ants, insomuch that it will accompany these insects upon their expeditions, and return with them to their usual nest.—It is called both by the Mexicans and Spaniards the *mother of the ants*; but our author supposes that all the attachment which the snake shows to the ant-hills proceeds from its living on the ants themselves. The ancient Mexicans were wont to take delight in keeping an harmless green snake which they catched in the fields, and which when well fed, would grow to the length of five or six feet. It was generally kept in a tub, which it never left but to receive food from the hand of its master; and this it would take either mounted on his shoulder or coiled about his legs.

157 Aquatic animals.

The aquatic animals are innumerable. Clavigero mentions a species of frogs so large that a single one will weigh a pound, and which are excellent food.—Of fish proper for food, our author says that he has counted upwards of 100 species, without taking in the turtle, crab, lobster, or any other crustaceous animal. The sharks are well known for their voracity. A whole sheep's skin, and even a large butcher's knife, has been found in the belly of one of them. They are accustomed to follow vessels, to devour any filth that is thrown overboard; and, according to Oviedo, they have been known to keep up with ships sailing before a wind for no less than 500 miles. The bottetto is a fish about eight inches in length, but excessively thick. While this fish lies alive upon the beach it swells whenever it is touched to an enormous size, and boys often take pleasure in making it burst with a kick. The liver is so poisonous as to kill with strong convulsions in half an hour after it is eaten. The oechione is a round flat fish, of eight or ten inches in diameter; the under part of the body being perfectly flat but the upper part convex; and in the centre, which is the highest part it has a single eye as large as that of an ox, furnished with eye-lids like the eyes of land animals. This eye remains open even after the fish is dead, and has an hideous appearance, so as sometimes to strike the spectators with horror. Campoi endeavours to prove, that this is the fish named by Pliny *uranoscopos*. The Roman historian does not describe this fish; but Clavigero observes, that the name of *uranoscopos* might be equally applicable to all fish which have eyes upon the head that look up to the sky, as skates and other flat fish. The axolotl is a great ugly water-lizard, remarkable for having a periodical evacuation of blood from the uterus, like the human species. It is eatable, tastes like an eel, and the flesh is looked upon to be good in consumptions. There are likewise a vast variety of shells, sponges, and lithophyts. Hernandez gives the figure of a sponge sent to him from the Pacific Ocean, which was of the shape of a man's hand, but with ten or more fingers; of a clay colour, with black backs and red streaks, harder than the common sponges.

158 Insects.

Of flying and other minute insects, the number is prodigiously great. There are a variety of beetles: some of a green colour make a great noise in flying; on which account children are fond of them. There are great numbers of shining beetles, which make a delightful appearance at night, as well as the luminous flies which abound in the country. There are six kinds of bees and four kinds of wasps; of which last, one collects wax and honey of a very sweet taste: another is called the *wandering wasp* from its frequent changes of abode; and in consequence of these changes, it is constantly employed in collecting materials for its habitations. There is also a black hornet with a red tail, the sting of which is so large and strong, that it will not only penetrate a sugar-cane but even the trunk of a tree. The lake of Mexico abounds with a kind of fly, the eggs of which are deposited upon the flags and rushes in such quantities as to form large masses. These are collected by the fishermen, and carried to market for sale. They are eaten by both Mexicans and Spaniards, and have much the same taste as the caviare of fish. The Mexicans eat also the flies themselves ground and made up with salt-petre. There are abundance of gnats in the moist places and lakes; but the capital, though situated upon a lake, is entirely free from them. There are other flies which make no noise in their flight, but cause a violent itching by their bite; and if the part be scratched, an open wound is apt to ensue. The butterflies are in vast numbers, and their

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their wings glow with colours far ſuperior to thoſe of Europe; the figures of ſome of them are given by Hernandez. But notwithſtanding its beauties and advantages, Mexico is ſubject to the dreadful devaſtations of locuſts, which ſometimes occaſion the moſt deſtructive famines.

There are ſome of the worms of Mexico made uſe of by the inhabitants as food; others are poiſonous. There are great numbers of ſcolopendræ and ſcorpions, ſome of the former growing to an immenſe ſize. Hernandez ſays, that he has ſeen ſome of them two feet long and two inches thick. The ſcorpions are very numerous; and in the hot parts of the country their poiſon is ſo ſtrong as to kill children, and give terrible pain to adults. Their ſting is moſt dangerous during thoſe hours of the day, in which the ſun is hotteſt. In the province of Michuacan is a ſingular ſpecies of ant, larger than the common one, with a greyiſh body and black head. On its hinder part is a little bag full of a ſweet ſubſtance, of which children are very fond. The Mexicans ſuppoſe this to be a kind of honey collected by the inſect; but Clavigero thinks it rather is its eggs. There is a miſchievous kind of tick, which in the hot countries abounds among the graſs. From thence it eaſily gets upon the cloaths, and from them upon the ſkin. There it fixes with ſuch force, from the particular figure of its feet, that it can ſcarcely be got off. At firſt it ſeems nothing but a ſmall black ſpeck, but in a ſhort time enlarges to ſuch a degree, from the blood which it ſucks, that it equals the ſize of a bean, and then aſſumes a leaden colour. Oviedo ſays, that the beſt and ſafeſt method of getting ſpeedily rid of it is by anointing the part with oil, and then ſcraping it with a knife.—If it is not ſpeedily removed, a wound is made ſimilar to that which the nigera or chegoe makes. The following inſects were eaten by the ancient Mexicans; 1. The *atelepitz*, a marſh beetle, reſembling in ſhape and ſize the flying beetles, having four feet, and covered with an hard ſhell. 2. The *atopinan*, a marſh-graſshopper of a dark colour, and great ſize, being not leſs than ſix inches long and two broad. 3. The *ahuihuitla*, a worm which inhabits the Mexican lake, four inches long, and of the thickneſs of a gooſe-quill, of a tawny colour on the upper part of the body, and white upon the under part. It ſtings with its tail, which is hard and poiſonous. 4. The *ocuiliztac*, a black marſh-worm, which becomes white on being roaſted.

159 Curious zoophytes.

Among the curious productions of the animal kind to be met with in this country, Clavigero mentions a kind of zoophytes which he ſaw in the year 1751, in a houſe in the country, about ten miles from Angelopoli, towards the ſouth-eaſt. They were three or four inches long, and had four very ſlender feet, with two antennæ; but their body was nothing more than the fibres of the leaves, of the ſame ſhape, ſize, and colour with thoſe of the other leaves of the trees upon which theſe creatures were found. Gemelli deſcribes another kind of theſe zoophytes which are found in Manilla.

160 Silk and cochineal.

Mexico produces alſo ſilk-worms: and the manufacture of ſilk might be carried on to great advantage, were it not prohibited for ſome political reaſons. Beſides the common ſilk, there is another found in the woods, very white, ſoft, and ſtrong. It grows on the trees in ſeveral maritime places, particularly in dry ſeaſons. Unleſs by poor people, however, this ſilk is not turned to any uſe, partly from inattention to their intereſts, but "chiefly (ſays our author) to the obſtructions which would be thrown in the way of any one who ſhould attempt a trade of that kind. We know from Cortes's letters to Charles V. that ſilk uſed to be ſold in the Mexican markets; and ſome pictures are ſtill preſerved, done by the ancient Mexicans upon a paper made of ſilk."

Cochineal is one of the moſt valuable products of Mexico, and great care is taken to rear the inſect in different parts; but the beſt is that which comes from the province of Mizteca. Some have reckoned that more than 2500 bags of cochineal are ſent every year from Mizteca to Spain; and the trade in that article carried on by the city of Oaxaca is computed at 200,000 crowns value.

161 General deſcription of the inhabitants.

Though Mexico, as we have ſeen, was originally inhabited by a number of different nations, yet all of them reſembled each other pretty much, not only in character, but in external appearance. "They generally rather exceed (ſays our author) than fall under the middle ſize, and are well proportioned in all their limbs. They have good complexions, narrow foreheads, black eyes, clean, firm, white, and regular teeth; thick, black, coarſe, gloſſy hair; thin beards, and generally no hair upon their legs, thighs, and arms, their ſkin being of an olive colour. There is ſcarcely a nation on earth in which there are fewer perſons deformed; and it would be more difficult to find a ſingle hump-backed, lame, or ſquint-eyed man among a thouſand Mexicans, than among an hundred of any other nation. The unpleaſantneſs of their colour, the ſmallneſs of their foreheads, the thinneſs of their beards, and the coarſeneſs of their hair, are ſo far compenſated by the regularity and fine proportion of their limbs, that they can neither be called very beautiful nor the contrary, but ſeem to hold a middle place between the extremes. Their appearance neither engages nor diſguſts; but among the young women of Mexico, there are many very beautiful and fair, whoſe beauty is at the ſame time rendered more winning by the natural ſweetneſs of their manner of ſpeaking, and by the pleaſantneſs and natural modeſty of their whole behaviour. Their ſenſes are very acute, eſpecially that of ſight, which they enjoy unimpaired to the lateſt age. Their conſtitutions are ſound, and their health robuſt. They are entirely free of many diſorders which are common among the Spaniards; but of the epidemical diſeaſes to which their country is occaſionally ſubject, they are generally the victims: with them theſe diſeaſes begin, and with them they end. One never perceives in a Mexican that ſtinking breath which is occaſioned in other people by the corruption of the humours or indigeſtion. Their conſtitutions are phlegmatic; but the pituitous evacuations from their heads are very ſcanty, and they ſeldom ſpit. They become grey-headed and bald earlier than the Spaniards; and although moſt of them die of acute diſeaſes, it is not very uncommon among them to attain the age of an hundred. They are now, and ever have been, moderate in eating, but their paſſion for ſtrong liquors is carried to the greateſt exceſs. Formerly they were kept within bounds by the ſeverity of the laws; but

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now that these liquors are become so common, and drunkenness is unpunished, one half of the people seem to have lost their senses; and this, together with the poor manner in which they live, exposed to all the baneful impressions of disease, and destitute of the means of correcting them, is undoubtedly the principal cause of the havoc which is made among them by epidemical disorders.

"Many persons allow the Mexicans to possess a great talent of imitation, but deny them that of invention; a vulgar error, which is contradicted by the ancient history of that people. Their minds are affected by the same variety of passions with those of other nations, but not to an equal degree. The Mexicans seldom exhibit these transports of anger, or frenzies of love, which are so common in other countries. They are slow in their motions; and show a wonderful tenacity and steadiness in those works which require time and long continued attention. They are most patient of injury and hardship; and where they suspect no evil intention, are most grateful for any kindness shown: but some Spaniards, who cannot distinguish patience from insensibility, nor distrust from ingratitude, say proverbially, that the Indians are alike insensible to injuries or benefits. That habitual distrust which they entertain of all who are not of their nation prompts them often to lie and betray; so that good faith certainly has not been respected among them so much as it deserves. They are by nature taciturn, serious, and austere; and show more anxiety to punish crimes than to reward virtues.

"Generosity and perfect disinterestedness are the principal features of their character. Gold with the Mexicans has not that value which it enjoys elsewhere. They seem to give without reluctance what has cost them the utmost labour to acquire. The neglect of selfish interests, with the dislike which they bear to their rulers, and consequently their aversion to perform the tasks imposed by them, seem to have been the only grounds of that much exaggerated indolence with which the Americans have been charged; and, after all, there is no set of people in that country who labour more, or whose labour is more necessary. The respect paid by the young people to the old, and by children to their parents, seem to be feelings that are born with them. Parents are very fond of their children; but the affection which husbands bear to their wives is certainly less than that which wives bear to their husbands; and it is very common for the men to love their neighbours wives better than their own.

Courage and cowardice seem alternately so to affect their minds, that it is often difficult to determine whether the one or the other predominates. They meet dangers with intrepidity, when they proceed from natural causes, but are easily terrified by the stern look of a Spaniard. That stupid indifference about death and eternity, which many authors have thought inherent in the character of every American, is peculiar only to those who are yet so rude and uninformed as to have no idea of a future state."

Thus much with respect to the general character of the Mexicans: but our author observes, that "the modern Mexicans are not in all respects similar to the ancient, as the Greeks of these days have little resemblance to those who lived in the times of Plato and Pericles. The ancient Mexicans showed more fire, and were more sensible to the impressions of honour. They were more intrepid, more nimble, more active, more industrious; but they were at the same time more superstitious and cruel."

162 Of the Toltecas and Chichemecas.

The Toltecas, who first inhabited Mexico, were accounted much more polished than those who came after them, insomuch that in after ages it was customary to distinguish people of ingenuity and learning by the name of Toltecas. They always lived in society, collected into cities, under the government of kings, and had regular laws. They were more addicted to the arts of peace than of war; and it was to them that the succeeding nations owned themselves indebted for their knowledge of the culture of grain, cotton, pepper, &c. They understood the art of casting gold and silver, and melting them in whatever forms they pleased, acquiring also great reputation from their skill in cutting gems of all kinds; and they were besides well versed in the sciences of astronomy and chronology.

According to the ancient histories of these people, they observed, about an hundred years before the Christian era, how far the solar year exceeded the civil one; supplying the defect, as we do, by the addition of a day once in four years. In the year 660, while their monarchy continued in Tula, a celebrated astronomer, named Huematzin, assembled with the king's consent all the wise men of the nation; and, with their assistance, painted a famous book named *Teoamoxtli*, or "divide book," in which were represented, in very plain figures, the origin of the Indians, their dispersion after the confusion of tongues of Babel, their journey in Asia, their first settlements in America, the founding of the kingdom of Tula, and their progress till that time: but these, and other accounts of their great knowledge and accuracy, savour too much of exaggeration, or perhaps invention, from both which it is impossible to clear the Spaniards when speaking of American affairs.

163 Their progress in agriculture.

The Chichemecas derived their knowledge of agriculture from the Toltecas, and of consequence the Mexicans also. Being destitute of ploughs or animals of sufficient strength to assist them in their labour, they made use of an instrument of hard copper, which they called *coatl* or *coa*, but differing in shape either from a spade or mattock. They used copper axes to cut trees, the figure of which was the same with ours; only that they put the ax into the eye of the handle, instead of putting the handle into the eye of the ax as we do. They had several other instruments of agriculture, but the forms of them are not mentioned by historians. They watered their fields by means of the rivers and small torrents which came from the mountains; raising dams to collect them, and forming canals to conduct them properly to the places which required moisture. They used inclosures of stone, as well as hedges for the fields, using for their hedges the aloe plant, which is well calculated for the purpose; and what preparations were necessary they gave in December. They dibbled their maize: a method of sowing more slow indeed than the ordinary one, but which certainly repays the trouble by a vastly larger crop, as well as by saving a very considerable quantity of seed. Close to the newly-sown fields they commonly

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monly erected a small tower of wood, where a man kept watch, in order to drive away the birds that came to feed upon the grain; a custom still preserved among the Spaniards.

164 Magnificent gardens.

In the cultivation of their gardens, the Mexicans were extremely skilful and magnificent; planting in them not only kitchen herbs, but fruit-trees, medicinal herbs, and flowers, with great taste and regularity. Some of the royal gardens excited the admiration of the Spaniards so much, that Cortes, in a letter to Charles V. informed him that the garden at Huaxtepec was the most extensive, the most beautiful, and most delightful, that had ever been beheld. It was six miles in circumference, and watered by a beautiful river which crossed it; and there were pleasure-houses erected at proper distances from one another. It was for many years preserved by the Spaniards.——The plants most cultivated, next to maize, were cotton, cacao, and aloe; which last served a great many useful purposes. See ALOE.

165 Tame animals.

Though they had not the advantage of the larger quadrupeds, as horses, oxen, or sheep, they bred up an immense number of quadrupeds unknown in Europe. Private persons brought up the small quadrupeds already mentioned, resembling little dogs; as well as turkeys, quails, geese, ducks, and other kinds of fowl. In the houses of the great men were bred fish, deer, rabbits, and a variety of birds; and in the royal palaces, almost all the species of quadrupeds and winged animals to be found in these kingdoms were kept, as well as a great number of aquatic animals and reptiles. According to Clavigero, Montezuma II. surpassed all the kings in the world in this kind of magnificence; and there never was a nation equal to the Mexicans in the care they took in taming animals.

166 Paintings.

Painting was an art in great request among the Mexicans, and one of very great use; as it was only by means of paintings that they recorded their histories. This art they derived, like others, from the Toltecas. Some of these paintings were mere images of their gods, kings, heroes, or of terrestrial objects. Others were historical, containing an account of particular events; others mythological, of which a volume is preserved in the great library of the order of Bologna: others were codes of laws, civil and religious; while some were chronological, astronomical, or astrological; in which was represented their calendar, the position of the stars, changes of the moon, eclipses, and prognostications and variations of the weather. Great numbers of these were burned by the superstitious Spaniards, who imagined that they contained some emblems of heathen worship. They had likewise geographical paintings, which served not only to show the extent and boundaries of their possessions, but likewise the situation of places, the direction of the coasts, and the course of the rivers. In his first letter to Cha. V. Cortes says, that having made inquiries if there was any secure harbour for vessels on the Mexican coast, Montezuma presented him with a painting of the whole coast, from the port of Vera Cruz, at that time called *Chalchiuhuecan*, to the river Coatzacualco. Another author informs us also, that Cortes, in a long and difficult voyage which he made to the bay of Honduras, made use of a chart presented to him by the lords of Coatzacualco, in which all the places and rivers were marked from the coast of Coatzacualco to Huejacallan.

As every thing relating to the Mexican empire was thus delineated in painting, the artists were innumerable: and had the numerous paintings been preserved, we might by means of them have had a complete history of Mexico; but vast numbers were destroyed by the superstitious zeal of the Spaniards. The chief school of painting was in Tezcuco: and of the paintings made there they collected such a mass, that it resembled a little mountain; and to all these they set fire at once, to the inexpressible grief of the Indians, and even of themselves, when they came to know their error: for they were compelled afterwards to attempt to remedy the evil, by collecting all the paintings that could be found throughout the empire, and to obtain what information they could from the mouths of the Indians. But though they recovered many, these were still not sufficient; for, from that time forward, the possessors of paintings became so jealous, that they concealed them from the Spaniards with the utmost care; and it was in a manner impossible to make them part with a single piece.

The cloth on which these paintings were done was made of the thread of the aloe or a kind of palm; or they painted on sheeps skins or upon paper. This last was made of the leaves of a certain kind of aloe, steeped like hemp, and afterwards washed, stretched, and smoothed. They used also the bark of other trees, prepared with gum; but we are ignorant of the method they used in the manufacture. This paper is similar in thickness to the European pasteboard, but softer, smoother, and more easy for writing. In general it was made up in very long sheets, which they preserved in rolls, or folded like bed-skreens. The volume of Mexican paintings preserved in the library of Bologna, is a thick skin, ill dressed, composed of different pieces painted all over, and folded up in that manner. The beautiful colours which they employed both in their paintings and in their dyes, were obtained from wood, leaves, and the flowers of different plants, as well as from various animal substances. Their white was made from a kind of stone which burns into a fine plaster; or from a mineral, which after being made into a paste worked like clay, and formed into small balls, turns white in the fire like Spanish white. Their *black* was got from another mineral, which has a disagreeable smell, or from the soot of a kind of pine collected in small earthen vessels. They obtained *blue* and *azure* colours from indigo; but their mode of obtaining these was very different from that used by the moderns. They put the branches of the plant into hot, or rather lukewarm, water: and after having stirred them about for a sufficient time with a stick or laddle, they passed the water, when impregnated with the dye, into certain pots or cups in which they let it remain until the solid part of the dye was deposited; after which they poured off the water. This sediment was first dried in the sun, and afterwards put between two plates before a fire until it grew hard. They had another plant which likewise afforded a blue colour, but inferior to the indigo. *Red* was obtained from the seeds of the achiot or rocou,

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rocou, and *purple* from cochineal. Their *yellow* were ochre, and a colour extracted from the beautiful flower of a plant resembling artemisia. With nitre these flowers afforded a fine orange colour; and by means of alum they extracted other colours.

The Mexican painters were by no means arrived at much perfection in the knowledge of light and shade or of design; nevertheless, in some of the ancient paintings particularly in the portraits of the kings the proportions were exactly observed. But this was by no means the case in their common paintings: though this is ascribed by Clavigero, not to the want of skill in these painters, but to the haste with which the figures were executed, and of which the Spaniards were witnesses. Besides paintings however, the Mexicans are said to have employed hieroglyphics and characters: but this is absolutely denied by our author; who tells us, that "they represented material things by their proper figures; but in order to save labour, paper, and colours, they contented themselves with representing part of an object, which was sufficient to make it understood. But as we cannot understand the writings of others till we have learned to read them, in like manner those American authors, who say that Mexicans make use of characters, required to have been first instructed in the Mexican manner of representing objects, in order to have been able to understand the paintings which served them in place of writing. When they would represent any person, they painted a man, or a human head, and over it a figure expressing the meaning of his name, as appears in the figures of the Mexican kings. To express a city or village, they painted in like manner a figure which signified the same thing, with its name. To form their histories or annals, they painted on the margin of the cloth or paper the figures of the years in so many squares, and at the side of each square the event or events which happened that year; and if, on account of the number of years, the history of which they meant to relate, they could not all be contained in one canvas, they were continued on another. With respect to the order of representing the years and events, it was at the liberty of the historian to begin at which ever angle of the piece he pleased; but at the same time constantly observing, that if the painting began at the upper angle or the right-hand, he proceeded towards the left; but if it began, as it most commonly did, at the upper angle of the left hand he proceeded straight downwards. If he painted the first year at the lower angle of the left, he continued towards the right; but if he began at the lower angle of the right, he painted straight upwards; so that on the upper part of his canvas he never painted from left to right, nor ever on the lower part from right to left; never advanced upwards from the left, nor downwards from the right. When this method of the Mexicans is understood, it is easy to discover at first sight which is the beginning and which the ending of any historical painting. Their paintings, however, ought not to be considered as a regular full history, but only as monuments and aids of tradition. We cannot express too strongly the care which parents and masters took to instruct their children and pupils in the history of the nation. They made them learn speeches and discourses which they could not express by the pencil; they put the events of their ancestors into verse, and taught them to sing them. This tradition dispelled the doubts and undid the ambiguity which paintings alone might have occasioned; and, by the assistance of those monuments, perpetuated the memory of their heroes and of virtuous examples; their mythology, rites, laws, and customs.

167 They did not use hieroglyphics or characters.

168 Careful to preserve their traditions.

169 Preserved the memory of events by knotted threads.

"Nor did that people only make use of tradition, painting, and songs, to preserve the memory of events but also of threads of different colours and differently knotted. This curious method of the representation of things, however much used in Peru, does not appear to have been employed in the province of Anahuac, if not in the most early ages; for no traces of such monuments are now to be found. Boturini says, that after the most diligent search, he with difficulty found one in a place in Tlascula, the threads of which were already wasted and consumed by time. If those who peopled South America ever passed the country of Anahuac, they possibly might have left there this art, which was afterwards abandoned for that of painting; introduced by the Toltecans or some other nation still more ancient."

170 Their knowledge in sculpture,

The Mexicans arrived at greater perfection in sculpture, casting of metals, and mosaic works, than in painting. Sculpture was likewise one of the arts exercised by the ancient Toltecans; but the Mexicans had sculptors among them when they left their native country of Atztlan. Several of the Toltecan statues, however, were preserved till the time of the conquest, particularly that of the idol Tlaloc, placed upon the mountain of the same name, and some gigantic statues in one of their temples. Stone and wood were the usual materials of their statues; the former was worked with a chissel made of flint; and, in spite of the unfitness of the instrument, such was the phlegmatic nature of the people, that they surmounted every difficulty arising from the tediousness of the work. In their statues they learned to express all the attitudes and postures of which the human body is capable. They observed the proportions exactly, and could when necessary execute the most delicate strokes with the chissel. They not only made entire statues, but cut out in wood and in stone figures in basso relievo; of which kind are those of Montezuma II. and one of his sons, recorded with praises by Acosta. They also made statues of clay and wood, employing for these a chissel of copper. The number of their statues was in proportion to that of their idols; but so active were the Spanish priests in destroying these, that there is now scarce any vestige of them remaining. The foundation of the first church in Mexico was laid with idols; on which occasions many thousand statues of their gods were necessarily broke in peices. In casting of metals however, the Mexicans greatly excelled their works either of painting or sculpture. "The miracles they produced of this kind (says Clavigero), would not be credible, if, besides the testimony of those who saw them, a great number of curiosities of this kind had not been sent from Mexico to Europe. The works of gold and silver sent in presents from the conqueror Cortes to Charles V. filled the goldsmiths of Europe with astonishment; who, as several authors of that period attest, declared that they were altogether inimitable. The Mexican founders made both of gold and silver

171 Exceeded in the art of casting metals.

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silver the most perfect images of natural bodies. They made a fish in this manner, which had its scales alternately one of silver and the other of gold; a parrot with a moveable head, tongue, and wings; and an ape with a moveable head and feet, having a spindle in its hand in the attitude of spinning. They set gems in gold and silver, and made most curious jewellery of great value. In short, these sort of works were so admirably finished, that even the Spanish soldiers, all strong with the same wretched thirst for gold, valued the workmanship above the materials. This wonderful art, formerly practised by the Toltecas, the invention of which they ascribed to one of their gods, has been entirely lost by the debasement of the Indians, and the indolent neglect of the Spaniards. We are doubtful if there are any remains of those curious works; at least we apprehend that it would be more easy to find them in some of the cabinets of Europe than in all New Spain. Covetousness to profit by the materials must unquestionably have conquered all desire to preserve them as curiosities." The works of the Mexicans in gold and silver, executed with the hammer, were much inferior to those of the Europeans.

172 Beautiful mosaic,

But of all the works executed by the ancient Mexicans, those of mosaic were the most curious as well as most highly valued by themselves. These were made of the feathers of birds; and for procuring them they reared a great number of those birds of fine plumage, with which the country abounded, not only in the royal palaces, but also in private houses; and at certain seasons they carried off the feathers for these purposes, or to sell them at market. They valued particularly the feathers of the humming birds, on account of their smallness, fineness, and various colours; and in these, as well as other birds of fine plumage, nature supplied them not only with all the colours producible by art, but likewise with many which art cannot imitate. Their mosaic works, as well as indeed all others of the Mexicans, required infinite patience. At the undertaking of every work of this kind several artists assembled; and having agreed upon a design, and fixed their measures and proportions, each artist charged himself with the execution of a certain part of the image, and exerted himself so diligently in it, that he frequently spent a whole day in adjusting a feather; first trying one and then another, viewing it sometimes one way, then another, until he found one which gave his part that ideal perfection proposed to be attained. When the part which each artist undertook was done, they assembled again to form the entire image from them. If any part happened to be in the least deranged, it was wrought again until it was perfectly finished. They laid hold of the feathers with small pincers, that they might not do them the least injury, and pasted them on the cloth with some glutinous matter; then they united all the parts upon a little table or a plate of copper, and flattened them softly until they left the surface of the image so equal and smooth, that it appeared to be the work of a pencil. These works were prodigiously admired by the Spaniards "It is wonderful (says Acosta) how it was possible with the feathers of birds to execute works so fine and so equal, that they appear the performance of the pencil; and what neither the pencil nor the colours in painting can effect, they have, when viewed from a side, an appearance so beautiful, so lively, and so animated, that they give delight to the sight. Some Indians, who are able artists, copy whatever is painted with a pencil so exactly with plumage, that they rival the best painters of Spain." The last artist in this admirable kind of work lived lately in Pazcuaro, the capital of Michuacan; but it is most probable that the art either has already died or will die with him. A beautiful kind of mosaic was likewise done with broken shells; and this is still carried on in Guatimala. There were many other artists who formed figures in imitation of the mosaic works with flowers and leaves upon mats, which were made use of at festivals; and these were eagerly sought after by the Spanish nobility, on account of their singular beauty. Others imitated with silk the figures done with feathers; but these last were always greatly superior.

173 Their architecture.

The Mexicans were skilled in architecture even before they left their native country; and many edifices still remain which were constructed by them during their frequent journies from one place to another. At their first arrival on the lake, they had no other materials to build their houses with but reeds and mud, until the success of their commerce allowed them to purchase better materials. When the city came to its perfection, the houses of the principal people were constructed of stone and lime; they consisted of two floors, having halls, large court-yards, and chambers fitly disposed; the roofs were flat and terraced; the walls so well whitened, polished, and shining, that they appeared to the Spaniards when at a distance to have been constructed of silver. The floor was paved with plaster, perfectly level, plain, and smooth. Many of their houses were crowded with battlemets and turrets; and their gardens had fish-ponds, and the walks of them symmetrically laid out. The large houses had in general two entrances, the principal one to the street, the other to the canal: they had no wooden doors to their houses, but covered the entrance with small reeds, from whence they suspended a string of cocoa shells, or some other materials which would make a noise, so as to awake the attention of the family when any person lifted up the reeds to enter the house. —The houses of the poorer sort were constructed of reeds, unburnt bricks, stone, or mud; and the roofs made of a kind of long hay which grows plentifully in the fields, particularly in the warm parts of the country. For this purpose they used also the leaves of the aloe placed in the manner of tiles, to which they bear some resemblance both in thickness and shape. Out of the columns or supports of these houses was generally a tree in the vigour of its growth; by which means, besides the pleasure derived from its foliage and shade, they saved themselves some labour and expence. These houses had one or more apartments according to the circumstances of the family.

Our author is of opinion that the ancient Mexicans, understood the method of constructing arches or vaults, as appears, he says, from some remains of their buildings as well as from their paintings. They had likewise cornices and other ornaments of architecture. They had also square or cylindrical columns; but it is not known whether these had any capitals or not. They frequently adorned them with figures in *basso relievo*;

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relievo; but their great ambition was to have them all made out of one ſtone. The foundations of the large houſes in the capital were laid upon beams of cedar driven into the ground, on account of its want of ſolidity; and the ſame method is ſtill practiſed by the Spaniards. The roofs of theſe were made of cedar, fir, cypreſs, pine, &c. In the royal palaces the columns were of marble or even of alabaſter, which the Spaniards miſtook for jaſper. In the reign of Ahuizotl a new kind of ſtone, named *tetzontli*, was diſcovered in the Mexican lake, which was ever afterwards made uſe of for building. It is hard, light, and porous like a ſponge; by which means the lime adheres very firmly to it. It is valued likewiſe on account of its colour, which is a blood red. Some of the pavements were chequered with marble and other valuable ſtones.

174 Remarkable aqueducts.

The moſt remarkable pieces of Mexican architecture, however were their aqueducts. There were two which conveyed the water to the capital from the diſtance of two miles. Theſe were conſtructed of ſtone and cement five feet high, and two paces broad upon a road for that purpoſe upon the lake; by which the water was brought to the entrance of the city, from whence it was ſent forth in ſmaller channels to ſupply the different fountains. The famous aqueduct of Chempoallan, which was done in the 16th century, is worthy of being ranked among the greateſt in Europe. The conductor of this work was a Franciſcan miſſionary named *Tembleque*; and it was executed with great ſkill by the Chempoalleſe. The water was brought from a great diſtance, and the country through which it muſt paſs was mountainous and rocky; but every difficulty was overcome by the induſtry of the Mexicans. The aqueduct, including all the turnings and windings, exceeded 30 miles in length. The principal difficulty conſiſted in croſſing three great precipices, over which they were obliged to conſtruct three bridges, the firſt of 47, the ſecond of 13, and the third of 67 arches. The largeſt arch was 100 feet high, and 61 broad; ſo that a large veſſel could have paſſed under it. It muſt however, be obſerved, that in executing this undertaking, the Mexicans were undoubtedly aſſiſted by European tools, and the directions of European workmen; ſo that we cannot with ſtrict propriety call it one of their works.

Though the ancient Mexicans never uſed any inſtruments of iron in their works, they nevertheleſs executed beautiful engravings by means of tools made of flint ſtone. They wrought alſo marble, jaſper, alabaſter, itztli, and other valuable ſtones. Of itztli they made their looking glaſſes, which were ſometimes ſet in gold, the ſharp pieces which were ſet in their ſwords, and razors to ſhave with. Theſe laſt were made with ſuch expedition, that an artiſt could finiſh upwards of *an hundred* in an hour.

175 Excellent jewellers.

They were, as has already been obſerved, expert jewellers, and underſtood the art of cutting and poliſhing the ſtones, as well as of ſetting them. The gems moſt common in their country were the emeralds, amethyſts, cornelians, turquoiſes, and others unknown in Europe. Emeralds were ſo common, that no lord or noble wanted them; and none of them died without having one fixed to his lip, that it might ſerve him, as they imagined, in the other world, instead of a heart. When Cortes returned the firſt time to Spain, he brought with him five emeralds valued, by the jewellers there, at 100,000 ducats. The firſt was in the form of a roſe; the ſecond of an horn; the third of a little fiſh with eyes of gold; the fourth in the form of a bell, with a fine pearl for a clapper. The fifth was a ſmall cup with a foot of gold, and four little golden chains which united in a pearl in the form of a button. For this alone the Genoeſe merchants offered 40,000 ducats, in order to ſell it again to the grand ſignior. Beſides theſe, he had two emerald vaſes valued at 300,000 ducats: but theſe laſt were loſt by ſhipwreck in the unfortunate expedition of Charles V. againſt Algiers. There are no ſuch gems wrought at preſent, nor is it even known where the emerald mines are ſituated; though there are ſtill extant ſome enormous maſſes of this precious ſtone, particularly two in as many churches: but the prieſts take care to ſecure them with iron chains, leſt any body ſhould carry them off.

176 Manufactures of different kinds.

In other more common manufactures the Mexicans were by no means deficient. The earthen ware of Cholula was much praiſed by the Spaniards; and they had the art of ornamenting this kind of ware with various colours, though they did not underſtand the making of glaſs. Their carpenters wrought with inſtruments of copper; and there are ſtill remains of their labours which diſplay a tolerable ſkill. Almoſt every one was acquainted with the method of making cloth. Being deſtitute of wool, common ſilk, lint, or hemp, they were obliged to ſupply the deficiency by other materials. For wool they ſubſtituted cotton, for ſilk they uſed feathers, the wool of the hare or rabbit; and inſtead of lint and hemp, they uſed the fibrous part of the leaves of the aloe. From theſe laſt they obtained a thread as fine as from lint; and from ſome ſpecies they had a coarſer ſort reſembling hemp. To obtain this thread they ſoaked the leaves in water, cleaned them, expoſed them to the ſun, and then beat them till they were fit to be ſpun. Sometimes they interwove with their cotton the fineſt down on the belly of the rabbits or hares, after having ſpun it into thread; and of theſe they made moſt beautiful cloths which were particularly uſed for winter waiſtcoats for their lords. Their cotton manufactures were equal to any produced in Europe; they wove them with different figures and colours, repreſenting different animals and flowers. Of feathers interwoven with cotton they made mantles and bed-curtains, carpets, gowns, &c. Theſe were exceedingly beautiful; but this kind of manufactory is now loſt, though there are ſtill ſome of theſe garments in the poſſeſſion of the principal lords, who wear them upon ſolemn occaſions.

177 Their horrible religion.

All theſe advances towards civilization, however, in the ancient Mexicans, were much more than counterbalanced by the horrible barbarities they committed in their religious ceremonies, and in which they exceeded every nation on earth. Human ſacrifices were indeed in uſe among all the ancient heathens; but ſuch prodigious maſſacres as have been already related at the dedication of their temples, are unheard of in hiſtory. Whether they uſed theſe barbarous ſacrifices in their own country, or whether the practice began with that of the four Xochimilca priſoners, of whom we have already given an account, is not known;

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known; but as they only used their prisoners or slaves whom they bought in this way, it is impossible that during the infancy of their state, the number of human victims could have been very great. Most of those unhappy creatures perished by having their breasts opened, and their hearts pulled out; some were drowned, others starved to death with hunger; and sometimes they were burnt. Prisoners of high rank were allowed to die by what Clavigero calls the *gladiatorian* sacrifice, which was performed in the following manner. Near to the greater temple of large cities, in an open space of ground sufficient to contain an immense number of people, was a round terrace eight feet high, upon which was placed a large round stone resembling a millstone in shape, but much larger almost three feet high, well polished, and having figures cut upon it. On this stone, which was called *temalcatl*, the prisoner was placed, armed with a shield and short sword, and tied by one foot. Here he was encountered by a Mexican officer or soldier better armed than himself. If the prisoner was vanquished, he was carried, dead or alive, to the temple, where his heart was taken out and offered in the usual manner; but if he conquered six combatants, he gained his life and liberty. An instance, however, is given in which this custom was infringed; for the Huetzotzincas having taken the principal lord of Cholula, a man of singular bravery, he overcame seven combatants; not withstanding which he was put to death; but on this account the Huetzotzincas were rendered forever infamous among these nations.

178 Gladiatorian sacrifice.

179 Number of human victims annually sacrificed.

Historians differ concerning the number of victims who perished annually in these sacrifices: Clavigero inclines to think it was 20,000, but others make it much more. Zumarraga, the first bishop of Mexico, says in a letter of the 12th of June 1531, addressed to the general chapter of his order, that in that capital alone there were above 20,000 victims annually sacrificed. Some authors, quoted by Gomara, say that 50,000 were annually sacrificed in the various parts of the empire. Acosta says, that there was a certain day of the year on which they sacrificed 5000 victims, and another on which 20,000 were sacrificed. According to others they sacrificed, on the mountain Tepeyacac only, 20,000 annually to one of their female deities. On the other hand, Bartholomew de las Casas reduces the number of human victims to 50 or at most to 100. "We are strongly of opinion (says Clavigero), that all these authors have erred in the number; Las Casas by diminution, and the rest by exaggerating the truth."

180 Their monstrous austerities.

Besides these cruelties which they practised upon others, the Mexicans were accustomed to treat themselves with the most inhuman austerities, thinking that the diabolical rage of their deities would be appeased by human blood. "It makes one shudder (says Clavigero), to read the austerities which they practised upon themselves, either in atonement for their transgressions, or in preparation for their festivals. They mangled their flesh as if it had been insensible, and let their blood run in such profusion as if it had been a superfluous fluid in the body. The effusion of blood was frequent and daily with some of their priests. They pierced themselves with the sharpest spines of the aloe, and bored several parts of their bodies, particularly their ears, lips, tongue, and the fat of their arms and legs. Through the holes which they made with these spines they introduced peices of cane, the first of which were small; but every time this penitential suffering was renewed a thicker piece was made use of. The blood which flowed from them was carefully collected in the leaves of the plant *aczojatl*. They fixed the bloody spines in little balls of hay, which they exposed upon the battlements of the walls of the temple, to testify the penance which they did for the people. Those who exercised such severities upon themselves within the inclosure of the greater temple of Mexico, bathed in a pond that was formed there, and which, from being always tinged with blood, was called *ezapan*."

181 Their dress

The dress of the Mexicans was very simple; that of the men consisted only of a large belt or girdle, the two ends of which hung down before and behind; the women wore a square mantle, about four feet long; the two ends were tied upon the breast or upon one shoulder. The Mexican gown was also a piece of square cloth, in which the women wrapped themselves from the waist down to the middle of the leg. They wore also a small under-vest or waistcoat without sleeves, named *huepilli*.

The dress of the poorer sort was made of the thread of the mountain palm, or of coarse cotton; but those of better station wore the finest cotton, embellished with various colours, and figures of animals or flowers; or woven with feathers, or the fine hair of the rabbit, &c. The men wore two or three mantles, and the women three or four vests, and as many gowns, putting the longest undermost, so that a part of each of them might be seen. Their shoes were only soles of leather, or coarse cloth of the mountain palm tied with strings; but those of the great people were adorned with ribbands of gold and jewels. They all wore long hair, and thought themselves dishonoured by being shaved, or having their hair clipped, except the consecrated virgins in the temple. The women wore it loose; but the men tied it up in different forms, and adorned their heads with fine feathers, both when they danced and went to war. With this simplicity, however, they mixed no small quantity of extravagance. Besides feathers and jewels, with which they used to adorn their heads, they wore ear-rings, pendants at their upper lip, as well as many at their noses, necklaces, bracelets for the hands and arms, as well as certain rings like collars which they wore about their legs. The ear-rings of the poor were shells, pieces of crystal, amber, &c.; but the rich wore pearls, emeralds, amethysts, or other gems, set in gold.

Instead of soap the Mexicans used a kind of fruit called *copalxocotl*; the pulp of which is white, viscous, and very bitter, makes water white, raises a froth, and will clean linen like soap. They used also a kind of root named *amolli*, which is not unlike the *saponaria* of the old continent. It is now more used for washing the body, especially the head, than for clothes. Clavigero says that there is a kind of this root which dyes the hair of a golden colour, and that he has been witness to this effect on the hair of an old man.

182 Modern inhabitants, &c.

The principal inhabitants of Mexico, in modern times, are Spaniards sent hither by the court, to fill the

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the posts of government. They are obliged, like those in the mother-country who aspire to any ecclesiastical civil, or military employments, to prove that there have been neither heretics, Jews, Mohammedans, nor any person in their family who have been called before the inquisition for four generations. Merchants who are desirous of going to Mexico, as well as to other parts of America, without becoming colonists, are compelled to observe the same forms. They are also obliged to swear that they have 300 palms of merchandise, their own property, in the fleet in which they embark, and that they will not carry their wives with them. On these absurd conditions they become the principal agents of the European commerce with the Indies. Though their charter is only to continue three years, and a little longer for countries more remote, it is of great importance. To them alone belongs the right of selling, as commissioners, the major part of the cargo. If these laws were observed, the merchants stationed in the new world would be confined to dispose of what they have received on their own acount.

The predilection which administration has for Spaniards born in Europe, has reduced the Spanish Creoles to acquiesce in subordinate stations. The descendants of the companions of Cortes, and of those who came after them, being constantly excluded from all places of honour or of trust that were any way considerable have seen the gradual decay of the power that supported their fathers. The habit of being obliged to bear that unjust contempt with which they have been treated, has at last made them become really contemptible. They have totally lost, in the vices which originate from indolence, from the heat of the climate, and from a superfluous enjoyment of all things, that firmness and that sort of pride which have ever characterised their nation. A barbarous luxury, shameful pleasures, and romantic intrigues, have enervated all the vigour of their minds, and superstition hath completed the ruin of their virtues. Blindly devoted to priests too ignorant to enlighten them by their instructions, too depraved to edify them by their example, and too mercenary to attend to both these duties of their function, they have no attachment to any part of their religion but that which enfeebles the mind, and have neglected what might have contributed to rectify their morals.

The Mestees, who constitute the third order of citizens, are held in still greater contempt. It is well known that the court of Madrid, in order to replenish a part of that dreadful vacancy which the avarice and cruelty of the conquerors had occasioned, and to regain the confidence of those who had escaped their fury, encouraged as much as possible the marriage of Spaniards with Indian women. These alliances, which became pretty common throughout all America, were particularly frequent in Mexico, where the women had more understanding and were more agreeable than in other places. The Creoles transferred to this mixed progeny the contemptuous slight they received from the Europeans. Their condition, equivocal at first, in process of time was fixed between the whites and the blacks.

These blacks are not very numerous in Mexico. As the natives are more intelligent, more robust, and more industrious, than those of the other colonies, they have hardly introduced any Africans except such as were required either to indulge the caprice, or perform the domestic service, of rich people. These slaves, who are much beloved by their masters, on whom they absolutely depend, who purchased them at an extravagant price, and who make them the ministers of their pleasures, take advantage of the high favour they enjoy, to oppress the Mexicans. They assume over these men, who are called *free*, an ascendant which keeps up an implacable hatred between the two nations. The law has studied to encourage this aversion, by taking effectual measures to prevent all connection between them. Negroes are prohibited from having any amorous correspondence with the Indians; the men, on pain of being mutilated; the women, of being severely punished. On all these accounts, the Africans, who in other settlements are enemies to Europeans, are in the Spanish Indies their warm friends.

Authority has no need of this support, at least in Mexico, where population is no longer what it was formerly. The first historians, and those who copied them, have recorded, that the Spaniards found there 10,000,000 of souls. This is supposed to have been the exaggerated account of conquerors, to exalt the magnificence of their triumph; and it was adopted, without examination, with so much the more readiness, as it rendered them the more odious. We need only trace with attention the progress of those ruffians who at first desolated these fine countries, in order to be convinced that they had not succeeded in multiplying men at Mexico and the adjacent parts, but by depopulating the centre of the empire; and that the provinces which are remote from the capital, differed in nothing from the other deserts of South and North-America. It is making a great concession, to allow that the population of Mexico has only been exaggerated one-half: for it does not now much exceed 2,000,000.

183 Mexicans cruelly treated by the Spaniards.

It is generally believed, that the first conquerors massacred the Indians out of wantonness, and that even the priests incited them to these acts of ferocity. Undoubtedly these inhuman soldiers frequently shed blood without even an apparent motive; and certainly their fanatic missionaries did not oppose these barbarities as they ought to have done. This was not, however the real cause, the principal source of the depopulation of Mexico; it was the work of a slow tyranny, and of that avarice which exacted from its wretched inhabitants more rigorous toil than was compatible with their constitution and the climate.

This oppression was coeval with the conquest of the country. All the lands were divided between the crown, the companions of Cortes, and the grandees or ministers who were most in favour at the court of Spain. The Mexicans, appointed to the royal domains, were destined to public labours, which originally were considerable. The lot of those who were employed on the estates of individuals was still more wretched. All groaned under a dreadful yoke: they were ill-fed; they had no wages given them; and services were required of them, under which the most robust men would have sunk. Their misfortunes excited the compassion of Bartholomew de las Casas.

184 Bartholomew de las Casas takes their part.

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This man, so famous in the annals of the new world, had accompanied his father in the first voyage made by Columbus. The mildness and simplicity of the Indians affected him so strongly, that he made himself an ecclesiastic, in order to devote his labours to their conversion. But this soon became the least of his attention. As he was more a *man* than a *priest*, he felt more for the cruelties exercised against them than for their superstitions. He was continually hurrying from one hemisphere to the other, in order to comfort the people for whom he had conceived an attachment, or to soften their tyrants. This conduct which made him be idolized by the one and dreaded by the other, had not the success he expected. The hope of striking awe, by a character revered among the Spaniards, determined him to accept the bishopric of Chiapa in Mexico. When he was convinced that this dignity was an insufficient barrier against that avarice and cruelty which he endeavoured to check, he abdicated it. It was then that this courageous, firm, disinterested man, accused his country before the tribunal of the whole universe. In his account of the tyranny of the Spaniards in America, he accuses them of having destroyed 15,000,000 of Indians. They ventured to find fault with the acrimony of his style; but no one convicted him of exaggeration. His writings, which indicate the amiable turn of his disposition, and the sublimity of his sentiments, have stamped a disgrace upon his barbarous countrymen, which time hath not, and never will efface.

185 In consequence of which their condition is rendered somewhat easier,

The court of Madrid, awakened by the representations of the virtuous Las Casas, and by the indignation of the whole world, became sensible at last, that the tyranny it permitted was repugnant to religion, to humanity, and to policy, and resolved to break the chains of the Mexicans. Their liberty was now only constrained by the sole condition, that they should not quit the territory where they were settled. This precaution owed its origin to the fear that was entertained of their going to join the wandering savages to the north and south of the empire.

With their liberty their lands ought also to have been restored to them; but this was not done. This injustice compelled them to work solely for their oppressors. It was only decreed, that the Spaniards, in whose service they laboured, should stipulate to keep them well, and pay them to the amount of 5 l. 5 s. sterling a year.

From these profits the tribute imposed by government was subtracted, together with 4 s. 4½ d. for an institution which it is astonishing the conquerors should have thought of establishing. This was a fund set apart in each community, and appropriated to the relief of such Indians as were decayed or indisposed, and to their support under private or public calamities.

The distribution of this fund was committed to their caciques. These were not the descendants of those whom they found in the country at the time of the conquest. The Spaniards chose them from among those Indians who appeared the most attached to their interests; and were under no apprehension at making these dignities hereditary. Their authority was limited to the supporting the police in their district, which in general extended eight or ten leagues; to the collecting the tribute of those Indians who laboured on their own account, that of the others being stopt by the masters whom they served; and to the preventing their flight by keeping them always under their inspection, and the not suffering them to contract any engagement without their consent. As a reward of their services, these magistrates obtained from government a property. They were permitted to take out of the common stock 2¼ d. annually for every Indian under their jurisdiction. At last they were empowered to get their fields cultivated by such young men as were not yet subject to the poll tax; and to employ girls, till the time of their marriage, in such occupations as were adapted to their sex, without allowing them any salary except their maintenance.

These institutions, which totally changed the condition of the Indians of Mexico, irritated the Spaniards to a degree not to be conceived. Their pride would not suffer them to consider the Americans as free men; nor would their avarice permit them to pay for labour which hitherto had cost them nothing. They employed themselves successively, or in combination, craft, remonstrances, and violence, to effect the subversion of an arrangement which so strongly contradicted their warmest passions; but their efforts were ineffectual. Las Casas had raised up for his beloved Indians protectors who seconded his design with zeal and warmth. The Mexicans themselves, finding a support, impeached their oppressors before the tribunals; and even the tribunals that were either weak or in the interest of the court. They carried their resolution so far, as even unanimously to refuse to work for those who had treated any of their countrymen with injustice. This mutual agreement, more than any other circumstance, gave solidity to the regulations which had been decreed. The other, prescribed by the laws was, gradually established. There was no longer any regular system of oppression; but merely several of those particular vexations which a vanquished people, who have lost their government, can hardly avoid from those who have subdued it.

These clandestine acts of injustice did not prevent the Mexicans from recovering, from time to time, certain detached portions of that immense territory of which their fathers had been despoiled. They purchased them of the royal domain, or of the great proprietors. It was not their labour which enabled them to make these acquisitions; for this they were indebted to the happiness of having discovered some of them mines, others treasures, which had been concealed at the time of the conquest. The greatest number derived their resources from the priests and monks, to whom they owed their existence.

Even those who experienced a fortune less propitious, procured for themselves, by the sole profits of their pay, more conveniences than they had enjoyed before they underwent a foreign yoke. We should be very much deceived if we should judge of the ancient prosperity of the inhabitants of Mexico by what has been said of its emperor, its court, its capital, and the governors of its provinces. Despotism had there produced those fatal effects which it produces every where. The whole state was sacrificed to the caprices,

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caprices, pleasures, and magnificence, of a small number of persons.

The government drew considerable advantages from the mines which it caused to be worked, and still greater from those which were in the hands of individuals. The salt-works greatly added to its revenue. Those who followed agriculture, at the time of harvest paid in a kind of a third of all the produce of the lands, whether they belonged to them as their own property, or whether they were only the farmers of them. Men who lived by the chace, fishermen, potters, and all mechanics, paid the same proportion of their industry every month. Even the poor were taxed at certain fixed contributions, which their labour or their alms might put them in a condition to pay.

The Mexicans are now less unhappy. Our fruits, our corn, and our cattle, have rendered their food more wholesome, agreeable, and abundant. Their houses are better built, better disposed, and better furnished. Shoes, drawers, shirts, a garment of wool or cotton, a ruff, and a hat, constitute their dress. The dignity which it has been agreed to annex to these enjoyments has made them better economists and more laborious. This case, however, is far from being universal; it is even very uncommon in the vicinity of the mines, towns, and great roads, where tyranny seldom sleeps: but we often find it with satisfaction in remote parts, where the Spaniards are not numerous, and where they have in some measure become Mexicans.

The employments of this people are very various. The most intelligent, and those who are in easy circumstances, devote themselves to the most necessary and most useful manufactures, which are dispersed through the whole empire. The most beautiful manufactures, are established among the people of Tlascala. Their old capital, and the new one, which is called *Angelos*, are the centre of this industry. Here they manufacture cloth that is pretty fine, callicoes that have an agreeable appearance, certain slight silks, good hats, gold lace, embroidery, lace, glasses, and a great deal of hard-ware.

186 Manufactures and produce of the country.

The care of flocks affords a maintenance to some Mexicans, whom fortune or nature have not called to more distinguished employments. America, at the time it was discovered, had neither hogs, sheep, oxen, horses, nor even any domestic animal. Columbus carried some of these useful animals to St Domingo, from whence they were generally dispersed, and at Mexico more than in any other place. These have multiplied prodigiously. They count their horned cattle by thousands, whose skins are become an object of considerable exportation. The horses are degenerated, but the quality is compensated by the number. Hog's lard is here substituted for butter. Sheep's wool is dry, coarse, and bad, as it is every where between the tropics.

The vine and olive-tree have experienced the same degeneracy. The cultivation of them was at first prohibited, with a view of leaving a free market for the commodities of the mother country. In 1706, permission was given to the Jesuits, and a little afterwards to the marquis Del Valle, a descendant from Cortes, to cultivate them. The attempts have not proved successful. The trials, indeed, that have been made, have not been abandoned; but no person has solicited the liberty of following an example which did not promise any great emoluments. Other cultures have been more successful. Cotton, sugar, silk, cocoa, tobacco, and European corn, have all thriven in some degree. The Spaniards are encouraged to prosecute the labours which these cultures require, from the happy circumstance of their having discovered iron mines, which were entirely unknown to the Mexicans, as well as some mines of a kind of copper that is hard enough to serve for implements of husbandry. All these articles, however, for want of men and industry, are merely consumed within the country.—There is only the vanilla, indigo, and cochineal, which make part of the trade of Mexico with other nations.

New-Mexico, so called because of its being discovered later than Old-Mexico, a country of America, is bounded on the north by high mountains, beyond which is a country altogether unknown; by Louisiana on the east; by New Spain on the south; and on the west by the gulph of California, and the Rio Colorado; extending it is said, above 100 miles from east to west, and about 900 from south to north; but the twentieth part of the country within these limits is neither cultivated nor inhabited either by Spaniards or Indians. As it lies in the midst of the temperate zone, the climate, in general, is very pleasant; the summers, though very warm, are neither sultry nor unwholesome; and the winters, though pretty sharp, are far from being insupportable, and, for the most part, clear and healthy.

The greatest encomiums are lavished on the fertility of the soil, the richness of the mines, and the variety of valuable commodities produced in this country. It is said to be beautifully diversified with fields, meadows rising grounds, and rivers; abounding with fruit and timber trees, turquoises, emeralds, and other precious stones, mines of gold and silver, a great variety of wild and tame cattle, fish and fowls. Upon the whole, we may safely affirm, that New-Mexico is among the pleasantest, richest, and most plentiful countries in America, or any other part of the world. There are few great or navigable rivers in it; the most considerable are, the Rio Solado and Rio del Norte, which, with several smaller streams, fall into the gulph of Mexico. On the coast of the gulph are divers bays, ports, and creeks, which might be easily converted into excellent harbours if the Spaniards were possessed of any portion of that commercial spirit which animates the other maritime nations of Europe.

The Spanish writers tell us, that New-Mexico is inhabited by a great variety of Indian nations or tribes, totally unconnected with each other; but the principal are the Apaches, a brave, warlike, resolute people; fond of liberty, and the inveterate enemies of tyranny and oppression. About the close of the last century thinking themselves aggrieved by the Spanish government, they made a general insurrection, and did a great deal of mischief; but were at last obliged to submit, and have since been curbed by stronger garrisons. Most of the natives are now Christians. When

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the Spaniards first entered this country, they found the natives well clothed, their lands cultivated, their villages neat, and their houses built with stone. Their flocks also were numerous, and they lived more comfortably than most of the other savages of America. As to religion, they were idolaters, and worshipped the sun and moon; but whether they offered human sacrifices, we are not sufficiently informed.

As to the number of the provinces of this country, we can advance nothing certain: some writers making them only five, others 10, 15, 20, and 25; but adding no description, either of them or the towns contained in them, excepting the capital, Santa Fé, which we are told stands near the source of the Rio del Norte, in 36° of north latitude, and about 130 leagues from the gulph; that it is a well-built, handsome, rich town; and the seat of the bishop, suffragan of Mexico, as well as the governor of the province, who is subordinate to the viceroy of Mexico, or New-Spain.

MEYER (Felix), an eminent landscape painter was born at Winterthur in 1653, and received his earliest instruction from a painter at Nuremburg: but he was afterwards a disciple of Ermels, a good landscape painter, whose manner he entirely followed.—In search of still greater improvement, however, he travelled to Italy: but the climate not agreeing with his constitution, he retired to Switzerland; where, as he was indefatigable in surveying all the beauty, the wildness, and magnificence of nature in those romantic scenes, he made a multitude of noble designs, which procured him very high reputation. As he was not expert at painting figures, those which he inserted in his own pictures being very indifferent, such of his landscapes as were supplied with figures by Roos or Rugendas, are accounted most estimable. He died in 1713.

MEYSENS (John) a painter of considerable eminence, was born at Brussels in 1612; and at first was taught the principles of painting by Anthony van Opital, but afterwards he became a disciple of Nicholas vander Horst. When he commenced painter, he undertook both history and portrait: but the latter seems to have been his principal employment; and his reputation for that style of painting became very great throughout the Low Countries. His remarkable excellence consisted in his producing a very striking resemblance, in his finishing his pictures with a great deal of care, and in giving them a lively and good expression.

MEZERAY (Francis Eudicede), an eminent French historian, the son of Isaac Eudes a surgeon, was born at Rye, in Lower Normandy, in 1610; and took the surname of *Mezeray*, from a Hamlet near Rye. Having performed his studies at Caen, he discovered a strong inclination to poetry; but going to Paris, he, by the advice of one of his friends, applied himself to the study of politics and history, and procured the place of commissary at war, which he held for two campaigns. He then shut himself up in the college of St Barbe, in the midst of books and manuscripts; and, in 1643, published the first volume of the History of France, in folio; and some years after, the other two volumes. Mezeray in that work surpassed all who had written the history of France before him, and was rewarded by the king with a pension of 4000 livres. In 1668, he published an abridgement of his History of France, in three volumes 4to, which was well received by the public: but as he inserted in that work the origin of most of the taxes with very free reflections, Mr Colbert complained of it, when Mezeray promised to correct what he had done in a second edition; but those corrections being only palliations, the minister caused half of his pension to be suppressed. Mezeray complained of this in very severe terms; when he obtained no other answer than the suppression of the other half. Vexed at this treatment, he resolved to write on subjects that could not expose him to such disappointments; and composed his treatise on the origin of the French, which did him much honour. He was elected perpetual secretary to the French academy; and died in 1683. He is said to have been a man extremely negligent in his person; and so careless in dress, that he might have passed for a beggar rather than for what he was. He was actually seized one morning by the *archers des pauvres*, or parish-officers; which mistake was so far from provoking him, that he was highly diverted with it, and told them, that "he was not able to walk on foot, but that as soon as a new wheel was put to his chariot, he would attend them wherever they thought proper." He used to study and write by candle-light, even at noon-day in summer; and, as if there had been no sun in the world, always waited upon his company to the door with a candle in his hand. With regard to religion, he affected Pyrrhonism; which however was not, it seems, so much in his heart as in his mouth. This appeared from his last sickness; for having sent for those friends who had been the most usual witnesses of his licentious talk about religion, he made a sort of recantation, which he concluded with desiring them "to forget what he might formerly have said upon the subject of religion, and to remember, that Mezeray dying was a better believer than Mezeray in health." Besides his history, he also wrote, 1. A continuation of the history of the Turks. 2. A French translation of John de Sarisbury's Latin treatise on the vanities of the court. 3. There are attributed to him several satires against the government; and in particular, those that bear the name of *Sandricourt*.

MEZIERS, a strong town of France in Champagne, with a citadel. It was besieged with a powerful army by Charles V. who was obliged to raise the siege in 1521. It is seated on the river Meuse, partly upon a hill, and partly in a valley, in E. Long. 3. 48. N. Lat. 49. 46.

MEZIRIAC (Claude Gaspar Backet Sieur de), one of the most ingenious men of the 17th century, was born at Bresse, of an ancient and noble family. He was a good poet in French, Italian, and Latin; an excellent grammarian, a great Greek scholar, and an admirable critic. He was well versed in the controversies; both in philosophy and religion; and was deeply skilled in algebra and geometry, of which last he gave proof by publishing the six books of Diophantes, enriched with a very able Commentary and Notes. In his youth he spent a considerable time at Paris and at Rome; at which last place he wrote a small collection of Italian poems, in competition with Vaugelas, who was there at the same time; among which there are imitations

imitations of the moſt beautiful ſimilies contained in the eight firſt books of the Æneid. He alſo tranſlated Ovid's Epiſtles; a great part of which he illuſtrated with very curious Commentaries of his own. While he was at Paris, they talked of making him preceptor of Louis XIII.: upon which he left the court in great haſte, and afterwards declared that he had never felt ſo much pain upon any occaſion of his life; for he ſeemed to have already upon his ſhoulders the important weight of the whole kingdom. He undertook the tranſlation of all Plutarch's works, with notes; which he had brought nearly to a concluſion, when he died at Bourg, in Breſſe, anno 1638, at 45 years of age. He left behind him ſeveral finiſhed works, that were not printed.

MEZUZOTH, in the Jewiſh cuſtoms, certain pieces of parchment which the Jews fix to the door-poſts of their houſes, taking that literally which Moſes commands them, ſaying, "Thou ſhalt never forget the laws of thy God, but thou ſhalt write them upon the poſts of thy houſe, and on thy gates." This expreſſion means nothing elſe, but that thou ſhalt always remember them, whether thou comeſt into thy houſe or goeſt out. But the Hebrew doctors imagined, that the lawgiver meant ſomething more than this. They pretended, that to avoid making themſelves ridiculous, by writing the commandments of God without their doors, or rather to avoid expoſing themſelves to the profanation of the wicked, they ought at leaſt to write them on a parchment, and to incloſe it in ſomething. Therefore they wrote theſe words upon a ſquare piece of parchment prepared on purpoſe, with a particular ink, and a ſquare kind of character. Deut. vi. 4, 5, 6, 7, 8, 9. "Hear, O Iſrael, the Lord our God is one Lord, &c."—Then they left a little ſpace, and afterwards went on, Deut. xi. 13. "And it ſhall come to paſs, if thou ſhalt hearken diligently to my commandments, &c." as far as, "Thou ſhalt write them upon the door-poſts of thy houſe, &c." After this they rolled up the parchment, and put it into a caſe of reeds or other matter; they wrote on the end of the caſe the word *Shadai*, which is one of the names of God; and they put it at the doors of their houſes, chambers, and all places moſt frequented; they fixed it to the knockers of the door, on the right ſide: and as often as they entered in or went out they touched it in this place, with the end of their finger, which they afterwards kiſſed out of devotion. The Hebrew word *mezuza* properly ſignifies the door-poſts of a houſe; but it is alſo given to this roll of parchment now mentioned.

MEZZOTINTO, a particular manner of repreſenting figures on copper, ſo as to form prints in imitation of painting in Indian ink. See ENGRAVING.

The invention of this art has been uſually attributed to prince Rupert. But Baron Heinikin, a very judicious and accurate writer upon the ſubject of engraving, aſſerts, with great appearance of truth, that it was a lieutenant-colonel de Siegan, an officer in the ſervice of the landgrave of Heſſe, who firſt engraved in this manner; and that the print which he produced was a portrait of the princeſs Amelia Elizabeth of Heſſe, engraved in the year 1643. Prince Rupert learned the ſecret from this gentleman, and brought it into England when he came over the ſecond time with Charles II. Prince Rupert's print of An Executioner holding a Sword in one Hand and a Head in the other, a half length, from Spagnoletto, is dated 1658. This art has never been cultivated with ſucceſs in any country but England.

The prince laid his grounds on the plate with a channelled roller; but one Sherwin, about the ſame time, laid his grounds with a half-round file, which was preſſed down with a heavy piece of lead. Both theſe grounding tools have been laid aſide for many years; and a hand-tool, reſembling a ſhoemaker's cutting-board-knife, with a fine crenelling on the edge, was introduced by one Edial, a ſmith by trade, who afterwards became a mezzotinto painter.

It is very different from the common way of engraving. To perform it, they rake, hatch, or punch, the ſurface of the plate all over with a knife, or inſtrument made for the purpoſe, firſt one way, then the other, acroſs, &c. till the ſurface of the plate be thus entirely furrowed with lines or furrows, cloſe and as it were contiguous to each other; ſo that, if an impreſſion was then taken from it, it would be one uniform blot or ſmut. This done, the deſign is drawn or marked on the ſame face; after which, they proceed with burniſhers, ſcrapers, &c. to expunge and take out the dents or furrows, in all the parts where the lights of the piece are to be; and that more or leſs as the lights are to be ſtronger or fainter; leaving thoſe parts black which are to repreſent the ſhadows or deepenings of the draught.

As it is much eaſier to ſcrape or burniſh away parts of a dark ground correſponding with the outline of any deſign ſketched upon it, than to form ſhades upon a light ground by an infinite number of hatches, ſtrokes, and points, which muſt all terminate with exactneſs on the outline, as well as differ in their force and manner; the method of ſcraping, as it is called, in mezzotinto, conſequently becomes much more eaſy and expeditious than any other method of engraving. The inſtruments uſed in this kind of engraving are cradles, ſcrapers, and burniſhers.

In this engraving, the plate muſt be prepared and poliſhed in the ſame manner as for other engraving; and afterwards divided equally by lines parallel to each other, and traced out with very ſoft chalk.—The diſtance of theſe lines ſhould be about one-third of the length of the face of the cradle which is to be uſed, and theſe lines ſhould be marked with capital letters, or ſtrokes of the chalk. The cradle is then to be placed exactly betwixt the two firſt lines, and paſſed forwards in the ſame direction; being kept as ſteady as poſſible, and preſſed upon with a moderate force. The ſame operation muſt be repeated with reſpect to all the other lines; till the inſtrument has thus paſſed over the whole ſurface of the plate.—Other lines muſt be then drawn from the extremities of the other two ſides, in the ſame manner; which, interſecting the firſt at right angles, will with them form ſquares; and the ſame operation muſt be repeated with the cradle as in the caſe of the firſt. New lines muſt then be drawn diagonally, and the cradle paſſed betwixt them as before; and when the firſt diagonal operation is performed, the lines muſt be croſſed at right angles as the former, and the cradles

Mezzotinto.

cradles paſſed betwixt them in the ſame manner.—The plate having undergone the action of the cradle, according to the diſpoſition of the firſt order of lines, a ſecond ſet muſt be formed, having the ſame diſtances from each other as the firſt. But they muſt be ſo placed as to divide thoſe already made into ſpaces one-third leſs than their whole extent; *i. e.* every one after the firſt on each ſide will take in one-third of that before it, *e. g.* beginning at A, of which the firſt third muſt be left out; a third of B will conſequently be taken in, and ſo of the reſt. Theſe lines of the ſecond order muſt be marked with ſmall letters, or leſſer ſtrokes to diſtinguiſh them from the firſt: and the ſame treatment of the plate muſt be purſued with reſpect to them as was practiſed for the others. When this ſecond operation is finiſhed, a third order of lines muſt be made; the firſt of which, *e.g.* in A, muſt omit two-thirds of it, and conſequently take in two-thirds of B, &c. By theſe means, the original ſpaces will be exactly divided into equal thirds; and the cradle muſt be again employed betwixt theſe lines as before.—When the whole of this operation is finiſhed, it is called *one turn;* but in order to produce a very dark and uniform ground, the plate muſt undergo the repetition of all theſe ſeveral operations for above twenty times; beginning to paſs the cradle again betwixt the firſt lines, and proceeding in the ſame manner through all the reſt. When the plate is prepared with a proper ground, the ſketch muſt be chalked on it, by rubbing the paper on the backſide with chalk. It is alſo proper to overtrace it afterwards with black lead or Indian ink. The ſcraping is then performed, by pairing or cutting away the grain of the ground in various degrees; ſo that none of it is left in the original ſtate except in the touches of the ſtrongeſt ſhade. The general manner of proceeding is the ſame as drawing with white upon black paper. The maſſes of light are firſt begun with; and thoſe parts which go off into light in their upper part, but are brown below: the reflections are then entered upon; after which the plate is blackened with a printer's blacking-ball made of felt in order to diſcover the effect; and then the work is proceeded with; obſerving always to begin every part in the places where the ſtrongeſt lights are to be.

The art of ſcrapiug mezzotintoes has been applied to the printing with a variety of colours, in order to produce the reſemblance of paintings. The inventor of the method of doing this was J. C. Le Blon, a native of Frankfort, and pupil of Carlo Maratta, between the years 1720 and 1730. It was eſtabliſhed by the inventor on this principle, that there are three primitive colours, of which all the reſt may be compoſed by mixing them in various proportions; that any two of theſe colours being mixed together, preſerve their original power, and only produce a third colour ſuch as their compound muſt neceſſarily give; but if tranſparent colours be mixed, and three primitive kinds compounded together, they deſtroy each other, and produce black, or a tendency to it, in proportion to the equality or inequality of the mixture; and that if, therefore, theſe three colours be laid, either ſeparately or upon each other, by three plates, engraved correſpondently on theſe principles to the colouring of the deſign the whole variety of teints neceſſary may be produced, The requiſites, therefore, to the execution of any deſign in this method of printing are as follow: 1. To ſettle a plan of the colouring to be imitated; ſhowing where the preſence of each of the three ſimple colours is neceſſary, either in its pure ſtate or combined with ſome other to produce the effect required; and to reduce this plan to a painted ſketch of each, in which not only the proper outlines, but the degree of ſtrength ſhould be expreſſed. 2. To engrave three plates according to this plan, which may print each of the colours exactly in the places where, and proportion in which, they are wanted. 3. To find three tranſparent ſubſtances proper for printing with theſe three primitive colours. The manner in which Mr Le Blon prepared the plates was as follows: The three plates of copper were firſt well fitted with reſpect to ſize and figure to each other, and grounded in the ſame manner as thoſe deſigned for mezzotinto prints; and the exact place and boundary of each of the three primitive colours, conformably to the deſign, were ſketched out on three papers, anſwering in dimenſions to the plate. Theſe ſketches were then chalked on the plates; and all the parts of each plate that were not to convey the colour to which it was appropriated to the print, were entirely ſcraped away, as in forming the light of mezzotinto prints. The parts that were to convey the colours were then worked upon; and where the moſt light or diluted teints of the colour were to be, the grain in the ground was proportionally taken off; but where the full colour was required, it was left entire. In this regard was had, not only to the effects of the colour in its ſimple ſtate, but to its combined operation, either in producing orange-colour, green, or purple, by its admixture with one alone; and likewiſe to its forming brown, grey, and ſhades of different degrees, by its co-operation with both the others. But though the greateſt part of the engraving was performed in the mezzotinto manner, yet the graver was employed occaſionally for ſtrengthening the ſhades, and for correcting the outline where it required great accuracy and ſteadineſs. It was found neceſſary ſometimes to have two ſeparate plates for printing the ſame colour, in order to produce a ſtronger effect: but the ſecond plate, which was uſed to print upon the firſt, was intended only to glaze and ſoften the colours in particular parts that might require it. With reſpect to the black and brown teints, which could not be ſo conveniently produced in a due degree by the mixture of the colours, umber and black were likewiſe uſed.

With reſpect to the order in which the plates are to be applied, it may be proper to obſerve, that the colour which is leaſt apparent in the picture ſhould be laid on firſt; that which is betwixt the moſt and leaſt apparent next; and that which predominates laſt; except where there may be occaſion for two plates for the ſame colour, as was before-mentioned; or where there is any required for adding browns and ſhades.

Mr Le Blon applied this art to portraits, and ſhowed, by the ſpecimens he produced, the poſſibility of its being brought, by farther improvements, to afford imitations of painting which might have ſome value. It is nevertheleſs much better adapted to the ſimpler ſubjects,

subjects, where there are fewer intermixtures of colours; and where the accuracy of the reflections, and demi-teints, are not so essentially necessary to the truth of the design, from the greater latitude of form, and disposition of the colour, as in plants, anatomical figures, and some subjects of architecture. But perhaps plates engraved or rather finished with the tool, particularly with respect to the outline, would be better accommodated in some of these cases than those prepared only by scraping.

Mr Cochin remarks, at the end of an account he has given of Mr Le Blon's manner, that though this ingenious artist confined his method principally to the use of three colours; yet, should this invention be again taken up and cultivated, there would be more probability of success in using a greater variety: and that several different kinds might be printed by one plate; provided they were laid on in their respectively proper places by printing-balls, which should be used for that colour only. His hint might however be very greatly improved, by the further assistance of pencils, accommodated to the plates, for laying on the colours in the proper parts.—For the method of taking off mezzotinto prints on glass, see *Back-painting*.

MIASMA, among physicians, a particular kind of effluvia, by which certain fevers, particularly intermittents are produced.

MICA, Daze, *Talc*, *Muscovy-glass*, *Glimmer*, or *Glist*; a genus of magnesian earths, known by the following characters: 1. They consist of thin flexible particles, divisible into plates or leaves, having a shining surface. 2. These leaves or scales, exposed to the fire, lose their flexibility and become brittle, separating afterwards into thinner leaves: but in a quick and strong fire they curl or crumple, which is a step towards fusion; though it is very difficult to reduce them into pure glass without addition. 3. They melt easily with borax, the microcosmic salt, and alkaline salt; and, by means of the two former salts, may be brought to a clear glass before the blow-pipe. That which contains iron, however, is more fusible than the uncoloured earths of this kind. No loose or friable mica has yet been discovered, but all of an indurated kind. Its specific gravity, according to Fabroni, is about 3000. Kirwan tells us, that the specific gravity of this substance, when it contains much iron, is from 2535 to 3000. An hundred parts of the colourless kind contain 38 of silex, 28 of argill, 20 of magnesia, and 14 of the most dephlogisticated calx of iron. Martial mica contains also 10 or 12 *per cent.* of a more phlogisticated calx of iron; whence its various colours are derived, and a proportionably smaller quantity of the other ingredients. The species are,

I. Mica alba, colourless or pure mica; of which there are the following varieties. 1. Muscovy glass, consisting of large parallel plates, and as transparent as glass, found in Siberia and Sweden. This differs externally from the common talc, in being more soapy to the touch. An hundred parts of it contain 50 of silex, 45 of mild magnesia, and 5 of argill or clay. Venetian talc is white, grey, yellowish, or greenish, and semitransparent. It is much more tender and brittle than mica, and so soft that it may be scratched with the nail. Its specific gravity is 2729. 2. Mica squamosa, composed of small plates, found in Sweden and other coutries of Europe. 3. Composed of fine particles like chaff. 4. Talcum officinale, crumpled mica, composed of crumpled plates.

II. Mica colorata martialis, coloured and martial glimmer. Of this there are many varieties. 1. Brown and semitransparent, found in Lapland. 2. Consisting of fine and minute scales, of a brown, deep-green, light-green, or black colour, found in different parts of Sweden. 3. Twisted or crumpled glimmer, of a light green colour, found also in Sweden. 4. Chaffy glimmer, of a black colour, found in the stone called *bornberg*, occurring in most of the Swedish copper mines, as at Norberg, Flodberg, &c. 5. Crystallized glimmer, with erect scales, or with hexagonal horizontal plates, found also in Sweden.

Most of these stones are supposed absolutely to resist the fire; but this is to be understood only of certain degrees of heat, and when they are mixed with certain bodies. Cronstedt observes, however, that they may with equal propriety be called *vitrescent*; because they melt with that degree of heat in which neither quartz nor limestone are in the smallest degree altered. They are still more readily melted when either naturally or artificially combined with a martial earth. Hence some ores, though much mixed with mica, may be very readily melted; while others, in which the same substance is mixed with quartz, it may be impossible to melt; because the mica renders the quartz so compact as to prevent it from cracking. It does the same with an apyrous clay, which is the reason why the lapis ollaris resists the fire so strongly.

M. Margraaf asserts, that he has obtained Epsom salt from talc; and Mr Fabroni informs us, that in decomposing nitre by means of a micaceous substance, as soon as the acid is distilled there rises some other substance hitherto unknown at the end of the operation: he adds, that on employing aqua regia or marine acid to dissolve this substance, the yellow colour which results from the solution shows that it contains some iron. This last assertion is confirmed by M. Monnet, who found that phlogisticated alkali and solution of galls produce a bluish colour with that of mica. He adds, that its component parts are the same with those of asbestos, excepting only that the latter contains more iron.

Cronstedt informs us, that the martial mica acquires a shining yellow colour in a calcining heat, which has induced many to examine it in hopes of finding gold; though no metal can be obtained from it except iron, which may be dissolved by means of aqua regia. A late German author indeed has pretended, that he produced from mica an unknown semimetal which resembled iron mixed with zinc. He owned, however, that he made use of a flux composed of several metals, some of which probably united with the talc, and thus deceived him. The talc cubes, which are micaceous bodies of the figure of aluminous crystals are much valued and sought after by some mineralogists. They are met with in some parts of Sweden; and when broken are found to consist of an iron ore frequently mixed with a marcasitical copper ore, and are only covered with a very thin coat of mica. The broad and transparent talc named *Muscovy-glass* is used instead of glass

glaſs for windows; and has this advantage above common glaſs, that it reſiſts the exploſion of cannon. Cronſtedt thinks that it might be advantageouſly uſed for covering houſes. The twiſted or crumpled mica, found in ſome places of Sweden, is manufactured into kettles and other veſſels, likewiſe into hearths for chimneys; "and the powder which falls in the working (ſays our author) may be mixed with the common ſalt for the diſtillation of the muriatic acid."

According to M. Magellan, many mineral ſubſtances may have the glittering appearance of talc without really belonging to that genus. An artificial production of this kind he happened to obſerve in Mr Wedgewood's work. It was an unexpected reſult from vitriol calcined to redneſs, then mixed without being waſhed with common ſalt. It now underwent a ſecond calcination under a muffle, with a heat ſomewhat ſtronger; about the tenth degree of his thermometer. The colour was of a dark purple, and the ſhining particles ſo bright as to ſhow their glaſſy form, very different from true mica.

MICAH, or *The Book of* MICAH, a canonical book of the Old Teſtament, written by the prophet Micah, who is the ſeventh of the twelve leſſer prophets. He is cited by Jeremiah, and prophesied in the days of Jotham, Ahaz, and Hezekiah. He cenſures the reigning vices of Jeruſalem and Samaria, and denounces the judgments of God againſt both kingdoms. He likewiſe foretels the confuſion of the enemies of the Jews, the coming of the Meſſiah, and the glorious ſucceſs of his church.

MICHAEL, or MICHEL, (i. e. *who is like to God?*) The ſcripture account of Michael is, that he was an archangel, who preſided over the Jewiſh nation, as other angels did over the Gentile world, as is evident of the kingdoms of Perſia and Greece, (Dan. x. 13.); that he had an army of angels under his command (Rev. xii. 7.); that he fought with the Dragon, or Satan and his angels; and that, contending with the Devil, he diſputed about the body of Moſes, (Jude 9.) As to the combat between Michael and the Dragon, ſome authors underſtand it literally, and think it means the expulſion of certain rebellious angels, with their head or leader, from the preſence of God. Others take it in a figurative ſenſe; and refer it, either to the conteſt that happened at Rome between St Peter and Simon Magus, in which the apoſtle prevailed over the magician, or to thoſe violent perſecutions under which the church laboured for three hundred years, and which happily ceaſed when the powers of the world became Chriſtians. Among the commentators who maintain the former opinion is Grotius; and among thoſe who take it in a figurative ſenſe are Hammond and Mede.

The conteſt about the body of Moſes is likewiſe taken both literally and figuratively. Thoſe who underſtand it literally are of opinion, that Michael by the order of God hid the body of Moſes after his death; and that the Devil endeavoured to diſcover it, as a fit means to entice the people to idolatry, by a ſuperſtitious worſhip of his relics. But this diſpute is figuratively underſtood to be a controverſy about rebuilding the temple, and reſtoring the ſervice of God among the Jews at Jeruſalem; the Jewiſh church being fitly enough ſtyled the body of Moſes. It is thought by ſome, that this ſtory of the conteſt between Michael and the Devil was taken by St Jude out of an apocryphal book called, *The Aſſumption of Moſes*.

The Romiſh church celebrates three appearances of Michael, of which no mention is made in ſcripture, and which have happened, they ſay, a long time after the age of the apoſtles. The firſt appearance of this archangel was at Coloſſæ in Phrygia, but at what time is uncertain. The ſecond is that of mount Garganus, in the kingdom of Naples, about the end of the fifth century. The third is his appearance to Aubert biſhop of Avranches, upon a rock called the *Tomb*, where at this day is the abbey of St Michael. This was about the year 706. The firſt of theſe feſtivals is obſerved on the 6th of September, the ſecond on the 8th of May, and the laſt on the 16th of October. It has been ſuppoſed, that it was Michael the archangel who conducted the Iſraelites in their journey through the wilderneſs, (ſee Ex. xxxii. 20, 23, and xxxiii. 2.); that it was he who appeared to Moſes in the burning buſh; who appeared to Joſhua in the fields of Jericho; and to Gideon and Manoah the father of Sampſon; and, in a word, to him have been imputed the greateſt part of the moſt remarkable appearances either in the Old or New Teſtament.

MICHAEL ANGELO. See ANGELO.

Mount MICHAEL, one of the moſt celebrated ſtate-priſons of France, lies about 20 miles from Granville. It is a rock ſituated in the middle of the bay of Avranches; and is only acceſſible at low water. Nature has completely fortified one ſide, by its craggy and almoſt perpendicular deſcent, which renders it impracticable to mount it by any addreſs or courage, however conſummate. The other parts are ſurrounded by walls fenced with ſemilunar towers after the Gothic manner; but ſufficiently ſtrong, together with the advantage of its ſituation, to render it impregnable to any attack. At the foot of the mountain begins a ſtreet or town, which winds round its baſe to a conſiderable height. Above are chambers where ſtate-priſoners are kept, and where there are other buildings intended for reſidence. On the ſummit is erected the abbey itſelf, occupying a prodigious ſpace of ground, and of a ſtrength and ſolidity equal to its enormous ſize; ſince it has for many centuries withſtood all the injuries of the weather, to which it is ſo much expoſed. In an apartment, called the *Sale de Chevalerie*, the knights of St Michael uſed to meet in ſolemn convocation on important occaſions. They were the defenders and guardians of this mountain and abbey, as thoſe of the temple, and of St John of Jeruſalem, were of the holy ſepulchre. The hall in which they met is very ſpacious, but rude and barbarous. At one end is a painting of the archangel, the patron of their order; and in this hall Louis XI. firſt inſtituted and inveſted with the inſignia of knighthood the chevaliers of the croſs of St Michael. There is a miſerable dark apartment, or rather dungeon, in which many eminent perſons were formerly confined. In the middle of it is a cage, compoſed of prodigious bars of wood; and the wicket which gives entrance into it is 10 or 12 inches in thickneſs. The inſide of it compriſes about 12 or 14 feet ſquare, and it is nearly 20 in height. Towards the latter end of the laſt century, a certain newſwriter in Holland, who had preſumed to print ſome very

Michael. very severe and sarcastic reflections on Madame de Maintenon, was confined to this place. Some months after his publication, he was induced, by a person sent expressly for that purpose, to make a tour into French Flanders. The moment he had quitted the Dutch territories, he was put under arrest; and immediately, by his majesty's express command, conducted to Mount Michael, where he was shut up in this cage. Here he lived upwards of 23 years; and here he at length expired. During the long nights of winter, no candle or fire was allowed him. He was not permitted to have any book. He saw no human face, except the gaoler, who came once every day to present him, through a hole in the wicket, with his little portion of bread and wine. No instrument was given him with which he could destroy himself; but he found means at length to draw out a nail from the wood with which he engraved, or cut on the bars of his cage, certain fleurs de lis and armorial bearings, which formed his only employment and recreation. They are very curiously performed considering the rudeness of his tool.

The subterraneous chambers in this mountain are said to be so numerous, that the gaolers themselves do not know them. There are certain dungeons called *aubliettes*, into which they were accustomed anciently to let down malefactors guilty of very heinous crimes; they provided them with a loaf of bread and a bottle of wine, and then they were totally forgotten, and left to perish by hunger in the dark vaults of the rock. This punishment, however, has not been inflicted by any king in the last or present century.

Here also is a remarkable chamber, in one corner of which is a kind of window: between this and the wall of the building is a very deep space, of near 100 feet perpendicular, at the bottom of which is another window opening to the sea. It is called the *Hole of Montgomeri*; and the history of it is as follows: In the year 1559, Henry II. king of France was unfortunately killed at a tournament by the count de Montgomeri. †. He was a Huguenot; and having escaped the massacre of Paris, made head against the royal forces in Normandy, supported by queen Elizabeth with arms and money. Being driven from his fortresses in these parts, he retired to a rock called the *Tombelaine*. This is another similar to Mount Michael; only three quarters of a league from it, and of nearly equal dimensions. At that time there was a castle upon it, which has since been demolished, and of which scarce any vestiges now remain. From this fortress, accessible only at low-water, he continually made excursions and annoyed the enemy, who never dared to attack him. He coined money, laid all the adjacent country under contribution, and rendered himself universally dreaded. Desirous, however, to surprise Mount Michael, he found means to engage one of the monks resident in the abbey; who promised to give him the signal for this enterprise by displaying a handkerchief. The monk having made the signal, betrayed him, and armed all his associates, who waited Montgomeri's arrival. The chieftain came, attended by 50 chosen soldiers, all desperate, and capable of any attempt. They crossed the sand; and having placed their scaling ladders, mounted one by one. As they came to the top they were dispatched, each in turn, without noise, Montgomeri, who followed last, discovered the perfidy, and escaped with only two of his men, with whom he regained the Tombelaine. They preserve with great care the ladders and grappling irons used on this occasion. The count was at last besieged and taken prisoner by the marechal de Matignon, in 1574, at Domfront, in Normandy; and Catharine de Medicis, who hated him for having been, though innocently, the cause of her husband's death, caused him to be immediately executed.

†See France n° 140.

Michael, St Michael's.

The church of Mount Michael is a great curiosity. It stands on nine pillars of most enormous dimensions, built on the solid rock. Each of them appears to be about 25 feet in circumference: besides these, there are two others much inferior in size, on which the centre of the church rests, and over which is the tower. The following is the legendary account of the origin of this church: In the reign of Childebert II. there was a bishop of Avranches named *St Aubert*. To this holy man the archangel Michael was pleased to appear one night, and ordered him to go to this rock to build a church. St Aubert treated this as a dream; upon which the angel appeared a second time; and being still disobeyed, he returned a third time, when, by way of imprinting his command upon the saint's memory, he made a hole in his skull, by touching it with his thumb. The skull is still preserved in the treasury of the church. It is inclosed in a little shrine of gold, and a crystal, which opens over the orifice, admits the gratification of curiosity by the minutest examination of it. The hole is of a size and shape proportionable to the thumb said to have produced it; but it is impossible to determine whether it has been really made by a knife or any other way. It is not to be supposed that the saint would forget such a sensible mark of the angel's displeasure; he therefore immediately repaired to the rock, and constructed a small church, as he had been commanded. Here, however, true history supplies the place of fable; and informs us, that it was in 966 when Richard the second duke of Normandy began to build the abbey. It was completed about the year 1070, under William the Conqueror, though many other additions, were made by succeeding abbots.

In the treasury of the church are innumerable other relics; among which some few have a real and intrinsic value. There is a fine head of Charles VI. of France, cut in a crystal, and the representation of a cockle-shell in gold, weighing many pounds, given by Richard II. duke of Normandy, when he founded the abbey. There is an arm said to belong to *St Richard* king of England; but who this saint was it must be very difficult to determine.

ST MICHAEL'S, a borough town of Cornwal, between St Columb and Truro, 247 miles from London. Though one of the oldest boroughs in the county by perscription, and of great note in the Saxons time, it is a mean hamlet in the parishes of Newland and St Enidore; yet it is governed by a portreeve, yearly chosen by a jury of the chief inhabitants, out of the six chief tenants, called deputy lords of the manor, because they hold lands in the borough. Here is no market, but two fairs. A court-leet is held here twice a year. This place was formerly called Modishole, and afterwards Michel. Its list of members begins in the 6th of Edward VI.

St Michael's Mount, in the county of Cornwal, in the corner of Mount's-Bay is a very high rock, only

only divided by the tide from the main-land, so that it is land and island twice a-day. The town here was burnt by the French in the reign of king Henry VIII. At the bottom of this mount, in digging for tin, there have been found spear-heads, battle axes, and swords, of brass, all wrapt up in linen. The county is contracted here into a sort of isthmus so that it is scarce four miles between the Channel and the Severn sea.—There have been large trees driven in by the sea between this mount and Penzance.

MICHAELIS (John David), a celebrated biblical critic, and author of many esteemed works, was the eldest son of Dr Christian Benedict Michaelis, professor in the university of Halle in Lower Saxony, and was born at that place Feb. 27. 1717. His father devoted him at an early age to an academical life; and with that view he received the first part of his education in a celebrated Prussian seminary, called the *Orphan-house* at Glanche, in the neighbourhood of his native place. He commenced his academical career at Halle in 1733, and took his master's degree in the faculty of philosophy in 1739. In 1741 he made an excursion to Britain, where his superior knowledge of the oriental languages, which was considerably increased by his indefatigable researches in the Bodleian library at Oxford, introduced him to the acquaintance, and gained him the esteem, of the first literary characters; with several of whom and particularly bishop Lowth, he was in correspondence for many years. On his return to Halle, after an absence of fifteen months, he began to read lectures on the historical books of the Old Testament, which he continued after his removal to Gottingen in 1745. In 1746 he was appointed professor extraordinary, and soon after professor of philosophy in that university. The next year he obtained a place of secretary to the royal society there, of which he was director in 1761, and was soon afterwards made Aulic counsellor by the court of Hanover. In 1764 his distinguished talents, but chiefly a publication relative to a journey to Arabia, which was undertaken by several literary men, at the expence of the king of Denmark, in consequence of his application by means of Count Bernsdorff, procured him the honour of being chosen a correspondent, and afterwards foreign member, of the academy of inscriptions at Paris, of whom the institution admitted only eight; and in the same year he became a member of the society of Haarlem. In 1775, Count Hopkin, who eighteen years before had prohibited the use of his writings at Upsal, when he was chancellor of that university, prevailed upon the king of Sweeden to confer on him the order of the polar star, as a national compensation. In 1786 he was raised to the distinguished rank of privy counsellor of justice by the court of Hanover; and in 1788 received his last literary honour, by being unanimously elected a fellow of the royal society of London.—His great critical knowledge of the Hebrew language, which he displayed in a new translation of the Bible, and in other works, raised him to a degree of eminence almost unknown before in Germany; and his indefatigable labours were only equalled by his desire of communicating the knowledge he acquired to the numerous students of all countries who frequented his admirable lectures, which he continued to deliver on various parts of the sacred writings in half yearly courses, and on the Hebrew, Arabic, and Syriac languages, to the last year of his life. He was professor in the university of Gottingen forty-five years, and, during that long period, he filled the chair with dignity, credit, and usefulness. He died October 22. 1791, aged 74. He is said to have left behind him several valuable MSS. Of the works that were published during his life-time, and which are very numerous, a catalogue, in the order of their publication, is given in the *Gentleman's Magazine* for march 1762.

MICHAELMAS, or *Feast of St* MICHAEL *and all Angels*, a festival of the Roman church, observed on the 29th of September. See MICHAEL.

MICKLE (William Julius), the celebrated translator of the Lusiad, was the son of the reverend Alexander Mickle a Scottish clergyman, who had formerly been a dissenting minister in London, an assistant to the reverend Dr Watts, and one of the translators of Bayle's Dictionary. This gentlemen having resided a few years in London, was presented to the church of Langholm near Kelso in Scotland, where he married; and our author was one of the younger sons. He was born about the year 1735, and was educated by his father. In his early years his passion for poetry frequently discovered itself; though till the age of 13 he did not show any particular attachment to books. At that time having accidentally met with Spencer's Fairy Queen, he became enamoured of his manner of writing, and instantly began to imitate him. After the death of his father, he came to Edinburgh to reside with an uncle who was a brewer there, and who admitted him into a share of his business; but not being qualified to succeed in this line, he went to London about the time of the conclusion of the war which began in 1755, with a view to procure a commission in the marine service. Here he was disappointed; but introduced himself to the first Lord Lyttelton, to whom he sent one of his poems. From his lordship, however, he received no other favour than being admitted to several interviews, and encouraged to persevere in his poetical plans.

So closely did our author cultivate the study of the muses, that before he was 18 years of age he had written two tragedies and half an epic poem; but all these were committed to the flames. The first of his poems which appeared in print was published in one of the Edinburgh magazines, and intitled, "On passing thro' the parliament Close of Edinburgh at Midnight." This was afterwards inserted in A collection of Original Poems by a Scotch gentleman, Vol. II. p. 137.

From the time of Mr Mickle's arrival at London till the year 1765, it is not known how he employed his time, though it is probable that he was employed in some branch of the printing business; and in 1765 he engaged himself as corrector to the Clarendon press. This year he published the poem which first brought him into notice, intitled, "Pollio, an Elegiac Ode, written in the Wood near R——.(Roslin) Castle," 4to. This was an elegy written on the death of his brother; which, previous to its publication, had been shown to Lord Lyttelton, and received some corrections from him. The latter, in an epistle to the author, spoke of it as equal to any thing of the kind in our language. In 1767 he published a poem called "The Concubine, in two Cantos, after the manner of Spencer,"

Spencer," 4to; and in 1769 he publiſhed, "A Letter to Mr Harwood, wherein ſome of his evaſive Gloſſes, falſe Tranſlations, and blundering Criticiſms, in ſupport of the Arian Hereſy, contained in his Literal Tranſlation of the New Teſtament, are pointed out and confuted," 8vo: and next year he publiſhed "Mary Queen of Scots, an elegy;" "Hengiſt and Mary a Ballad;" and "Knowledge, an Ode;" in Pearch's Collection of Poems. In 1770 he publiſhed "Voltaire in the Shades, or Dialogues on the Deiſtical Controverſy," 8vo. The Elegy on Mary had been ſubmitted to the judgment of Lord Lyttelton, who declined to criticiſe it, not for its deficiency in poetical merit, but from thinking differently from the author concerning that unfortunate princeſs.

About this time Mr Mickle was a frequent writer in the Whitehall Evening poſt; but a more important work now engaged his attention. When no more than 17 years of age he had read Caſtara's tranſlation of the Luſiad of Camoens into French, and then projected the deſign of giving an Engliſh tranſlation of it. From this, however, he was prevented by various avocations till the year 1771, when he publiſhed the firſt book as a ſpecimen: and having prepared himſelf by acquiring ſome knowledge of the Portugueſe language, he determined to apply himſelf entirely to this work. With this view he quitted his reſidence at Oxford, and went to a farm-houſe at Foreſt-hill, where he purſued his deſign with unremitting aſſiduity till the year 1775, when the work was entirely finiſhed,

During the time that Mr Mickle was engaged in this work he ſubſiſted entirely by his employment as corrector of the preſs; and on his quitting that employment he had only the ſubſcriptions he received for his tranſlation to ſupport him. Notwithſtanding theſe difficulties, he adhered ſteadily to the plan he had laid down and completed it in about five years.

When his work was finiſhed, Mr Mickle applied to a perſon of great rank, with whom his family had been connected, for permiſſion to dedicate it to him. Permiſſion was granted, and his patron honoured him with a very polite letter, but after receiving a copy, for which an extraordinary price was paid for the binding, he did not think proper to take any notice of the author. At laſt a gentleman of high rank in the political world, a firm friend to the author, and who afterwards took him under his protection, waited on the patron, and heard him declare that he had not read the work, but that it had been repreſented not to have the merit it was at firſt ſaid to poſſeſs. The applauſe with which the work was received, however, ſoon baniſhed from the author's mind thoſe diſagreeable ſenſations which had been occaſioned by the contemptuous neglect of his patron, as well as ſome ſevere criticiſms which had been circulated concerning it. A ſecond edition was prepared in 1778, with a plate prefixed to it, executed by the celebrated artiſt Mortimer; on whom Mr Mickle wrote an epitaph in 1779. This year alſo he publiſhed a pamphlet, intitled, "A Candid Examination of the reaſons for depriving the Eaſt India Company of its Charter, contained in The Hiſtory and Management of the Eaſt India Company from its Commencement to the Preſent Time; together with ſome Strictures on the Self-Contradictions and Hiſtorical Errors of Dr Adam Smith, in his Reaſons for the Abolition of the ſaid Company," 4to. About this time ſome of his friends thought of recommending him to the king as deſerving of a penſion; but this ſcheme was never put in execution. Dr Lowth, biſhop of London, would have put him into orders and provided for him in the church; but this was not agreeable to our author's diſpoſition. While he was meditating a publication of all his poems, in which he would moſt probably have found his account, he was appointed ſecretary to Commodore Johnſtone, who had lately obtained the command of the Romney man of war. In November 1779 he arrived at Liſbon, and was named by his patron joint agent for the prizes which were taken. In this capital and its neighbourhood he reſided more than ſix months, being every where received with every mark of politeneſs and attention; and during this period he compoſed his poem called "Almada Hill," which in 1781 was publiſhed in quarto. He collected alſo many particulars concerning the manners of the Portugueſe, which he intended alſo to have publiſhed. During his ſtay at Liſbon the royal academy was opened; and Mr Mickle, who was preſent at the ceremony of its commencement, had the honour to be admitted a member under the preſidency of Don John of Braganza duke of Laſoens. His preſence being thought neceſſary in England to attend to the proceedings of the courts of law reſpecting the condemnation of ſome of the prizes, he did not accompany the commodore in his laſt expedition, nor did he go any more to ſea. In 1782 he publiſhed "The Prophecy of Queen Emma, an ancient Ballad lately diſcovered, written by Johannes Turgottus, prior of Durham, in the reign of William Rufus; to which is added by the Editor, an Account of the Diſcovery, and Hints towards a Vindication of the Authenticity, of the Poems of Oſſian and Rowley," 8vo.

In June this year Mr Mickle married Miſs Tomkins, daughter of the perſon with whom he reſided at Foreſt-hill, while engaged in tranſlating the Luſiad. Having received ſome fortune with this lady, as well as made ſome money himſelf when in the ſervice of Commodore Johnſtone, he now enjoyed a comfortable independence. Having fixed his reſidence at Wheatley in Oxfordſhire, he devoted his time to the reviſion of his poetical works, which he propoſed to publiſh by ſubſcription; but the plan has not yet been carried into execution. The laſt ſeven years of his life were employed in writing for the European Magazine. The Fragments of Leo, and ſome of the moſt approved reviews of books, in that performance, were of his production. He died after a ſhort illneſs on the 25th of October 1788 at Wheatley, leaving one ſon behind him. His poetry poſſeſſes much beauty, variety, harmony of numbers, and vigour of imagination: his life was without reproach; his foibles were few and inoffenſive; his virtues many; and his genius very conſiderable.

MICROCOSM, a Greek term ſignifying the *little world*; uſed by ſome for *man*, as being ſuppoſed an epitome of the univerſe or great world.

MICROCOSMIC ACID. See PHOSPHORUS (*Acid of*).

MICRO-

Micrography, Micrometer.

MICROGRAPHY, the description of objects too minute to be viewed without the assistance of a microscope. See *Microscopic Objects*.

MICROMETER, an instrument, by the help of which the apparent magnitudes of objects viewed thro' telescopes or microscopes are measured with great exactness.

I. The first TELESCOPIC micrometers were only mechanical contrivances for measuring the image of an object in the focus of the object-glass. Before these contrivances were thought of, astronomers were accustomed to measure the field of view in each of their telescopes, by observing how much of the moon they could see through it, the semidiameter being reckoned at 15 or 16 minutes; and other distances were estimated by the eye, comparing them with the field of view. Mr Gascoigne, an English gentleman, however, fell upon a much more exact method, and had a Treatise on Optics prepared for the press; but he was killed during the civil wars in the service of Charles I. and his manuscript was never found. His instrument, however fell into the hands of Mr R. Townly who says, that by the help of it he could mark above 40,000 divisions in a foot.

Mr Gascoigne's instrument being shown to Dr Hooke, he gave a drawing and description of it, and proposed several improvements in it, which may be seen in Phil. Trans. abr. Vol. I. p. 217. Mr Gascoigne divided the image of an object, in the focus of the object-glass, by the approach of two pieces of metal ground to a very fine edge, in the place of which Dr Hooke would substitute two fine hairs stretched parallel to one another. Two other methods of Dr Hooke's, different from this, are described in his Posthumous Works, p. 497, 498. An account of several curious observations that Mr Gascoigne made by the help of his micrometer, particularly in the mensuration of the diameters of the moon and other planets, may be seen in the Phil. Trans. Vol. XLVIII. p. 190.

Mr Huygens, as appears by his System of Saturn, published in 1659, used to measure the apparent diameters of the planets, or any small angles, by first measuring the quantity of the field of view in his telescope; which, he says, is best done by observing the time which a star takes up in passing over it, and then preparing two or three long and slender brass plates, of various breadths, the sides of which were very straight, and converging to a small angle. In making use of these pieces of brass, he made them slide in two slits, that were made in the sides of the tube, opposite to the place of the image, and observed in what place it just covered the diameter of any planet, or any small distance that he wanted to measure. It was observed, however, by Sir Isaac Newton, that the diameters of planets, measured in this manner, will be larger than they should be, as all lucid objects appear to be when they are viewed upon dark ones.

In the Ephemerides of the Marquis of Malvasia published in 1662, it appears that he had a method of measuring small distances between fixed stars and the diameters of the planets, and also of taking accurate draughts of the spots of the moon; and this was by a net of silver wire, fixed in the common focus of the object and eye-glass. He also contrived to make one of two stars to pass along the threads of this net by turning it, or the telescope, as much as was necessary for that purpose; and he counted, by a pendulum-clock, beating seconds, the time that elapsed in its passage from one wire to another, which gave him the number of the minutes and seconds of a degree contained between the intervals of the wires of his net, with respect to the focal length of his telescope.

In 1666, Messrs Azout and Picard published a description of a micrometer, which was nearly the same with that of the Marquis of Malvasia, excepting the method of dividing it, which they performed with more exactness by a screw. In some cases they used threads of silk, as being finer than silver wires. Dechales also recommends a micrometer consisting of fine wires, or silken threads, the distances of which were exactly known, disposed in the form of a net, as peculiarly convenient for taking a map of the moon.

M. de la Hire says, that there is no method more simple or commodious for observing the digits of an eclipse than a net in the focus of the telescope. These, he says, were generally made of silken threads; and that for this particular purpose six concentric circles had also been made use of, drawn upon oiled paper; but he advises to draw the circles on very thin pieces of glass with the point of a diamond. He also gives several particular directions to assist persons in the use of them. In another memoir he shows a method of making use of the same net for all eclipses, by using a telescope with two object-glasses, and placing them at different distances from one another.

Different Constructions of Micrometers. The first we shall describe is that by Mr Huygens. Let ABCD be a section of the telescope at the principal focus of the object-glass, or where the wires are situated, which are placed in a short tube containing the eye-glass, and may be turned into any position by turning that tube; *m n* is a fine wire extended over its centre; *vw*, *xy*, are two straight plates whose edges are parallel and well defined, and perpendicular to *m n*; *vw* is fixed, and *xy* moves parallel to it by means of a screw, which carries two indexes over a graduated plate, to show the number of revolutions and parts of a revolution which it makes. Now to measure any angle, we must first ascertain the number of revolutions and parts of a revolution corresponding to some known angle, which may be thus done: 1st, Bring the inner edges of the plates exactly to coincide, and set each index to 0; turn the screw, and separate the plates to any distance; and observe the time a star *m* is in passing along the wire *mn* from one plate to the other: for that time, turned into minutes and seconds of a degree, will be the angle answering to the number of revolutions, or the angle corresponding to the distance. Thus, if d=cos. of the star's declination, we have 15′ *dm*, the angle corresponding to the distance; and hence by proportion, we find the angle answerring to any other. 2*dly*, Set up an object of a known diameter, or two objects at a given distance, and turn the screw till the edges of the plates become tangents to the object, or till their opening just takes in the distance of the two objects upon the wire *mn*; then from the diamater, or distance of the two objects from each other, and their distance from the glass, calculate the angle, and observe the number of revolutions and parts corresponding. 3*dly*, Take the diameter of the sun on any day, by making the edges of the plates tangents to the opposite limbs, and find, from

Micrometer.

Plate CCXCV. fig. 1.

MICROMETER

Plate CCXCV.

Fig. 1.

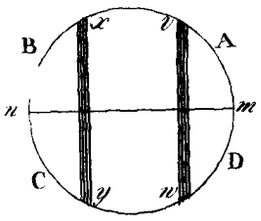
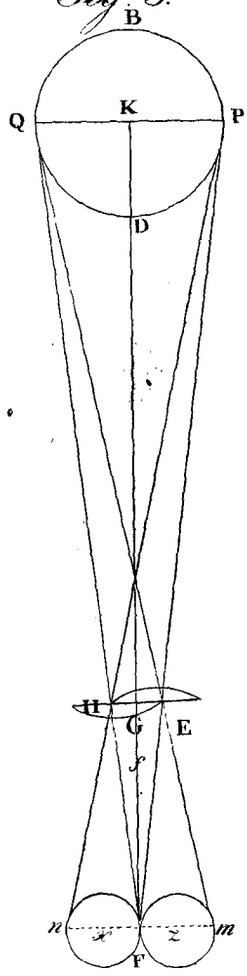


Fig. 3.



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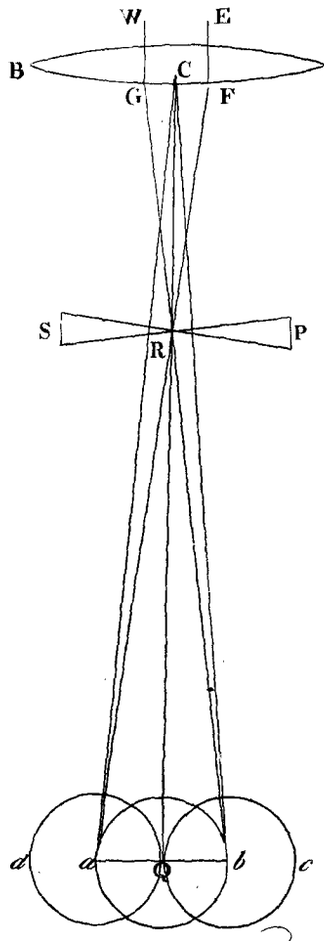

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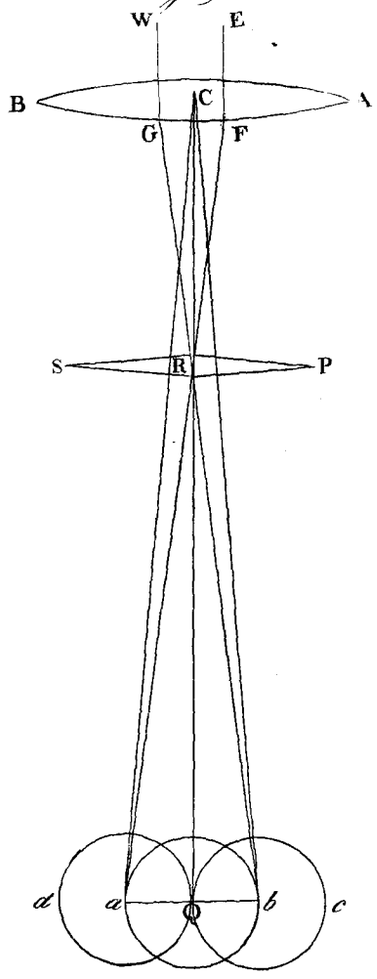

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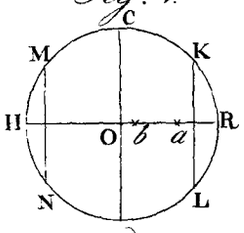

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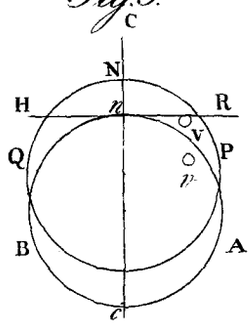

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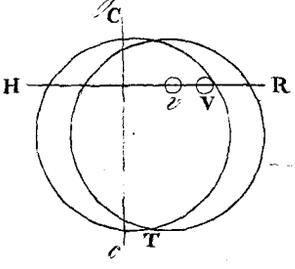

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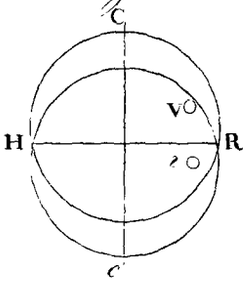


Fig. 10.

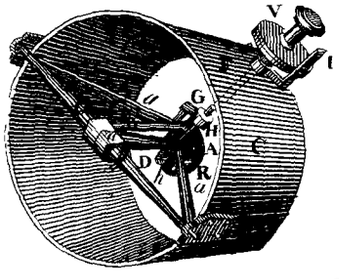
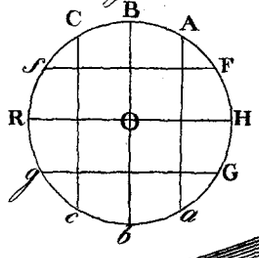


Fig. 2.



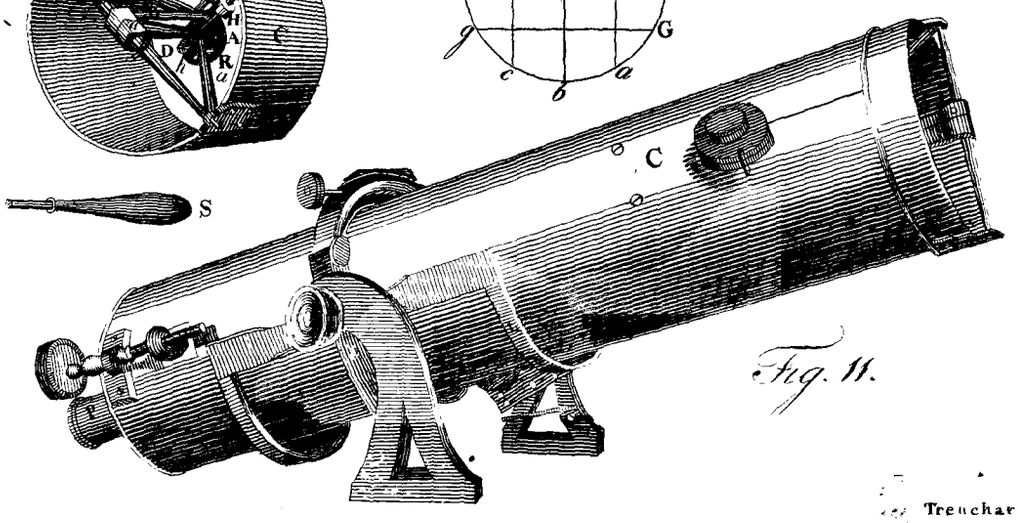


Fig. 11.

Treuchard

Micrometer.

from the nautical almanac, what is his diameter on that day. Here it will be best to take the upper and lower limbs of the sun when on the meridian, as he has then no motion perpendicular to the horizon. If the edges do not coincide when the indexes stand at o, we must allow for the error. Instead of making a proportion, it is better to have a table calculated to show the angle corresponding to every revolution and parts of a revolution. But the observer must remember, that when the micrometer is fixed to telescopes of different focal lengths, a new table must be made. The whole system of wires is turned about in its own plane, by turning the eye-tube round with a hand, and by that means the wire *m n* can be thrown into any position, and consequently angles in any position may be measured. Dr Bradley added a small motion by a rack and pinion to set the wires more accurately in any position.

Instead of two plates, two wires were afterwards put; and Sir Isaac Newton observed, that the diameters of the planets measured by the plates were somewhat bigger than they ought, as appeared by comparing Mr Huygens's measures with others taken with the wires; and also by comparing the diameter of mercury observed in and out of the sun's disk, the latter being the greatest. Dark objects on bright ones appear less, and light objects on dark ones appear greater, than if they were equally bright; owing, perhaps, to the brighter image on the retina diffusing itself into the darker: and the bright image of the planet being intercepted by the plates, the faint diffused light becomes more sensible, and is mistaken for the edge of the planet.

But the micrometer, as now contrived, is of use, not only to find the angular distance of bodies in the field of view at the same time, but also of those which, when the telescope is fixed, pass through the field of view successively; by which means we can find the difference of their right ascensions and declinations. Let A *a*, B *b*, C *c*, be three parallel and equidistant wires, the middle one bisecting the field of view; H O R a fixed wire perpendicular to them passing through the centre of the field; and F *f*, G *g*, two wires parallel to it, each moveable by a micrometer screw, as before, so that they can be brought up to H O R, or a little beyond. Then to find the angular distance of two objects, bring them very near to B*b*, and in a line parallel to it, by turning about the wires, and bring one upon H O R, and by the micrometer screw make F *f* or G *g* pass through the other; then turn the screw till that wire coincides with H O R, and the arc which the index has passed over shows their angular distance. If the objects be further remote than you can carry the distance of one of the wires F *f*, G *g*, from H O R, then bring one object to F *f* and the other to G *g*; and turn each micrometer screw till they meet, and the sum of the arcs passed over by each index gives their angular distance. If the objects be two stars, and one of them be made to run along H O R, or either of the moveable wires as occasion may require, the motion of the other will be parallel to these wires, and their difference of declinations may be observed with great exactness; but in taking any other distances, the motion of the stars being oblique to them, it is not quite so easy to get them parallel to B *b*; because if one star be brought near, and the eye be applied to the other to adjust the wires to it, the former star will have gotten a little away from the wire. Dr Bradley, in his account of the use of this micrometer, published by Dr Maskeleyne in the Philosophical Transactions for 1772, thinks the best way is to move the eye backwards and forwards as quick as possible; but it seems to me to be best to fix the eye at some point between, by which means it takes in both at once sufficiently well defined to compare them with B *b*. In finding the difference of declinations, if both bodies do not come into the field of view at the same time, make one run along the wire H O R, as before, and fix the telescope and wait till the other comes in, and then adjust one of the moveable wires to it, and bring it up to H O R, and the index gives the difference of their declinations. The difference of time between the passage of the star at either of the cross moveable wires, and the transit of the other star over the cross fixed wire (which represents a meridian), turned into degrees and minutes, will give the difference of right ascension. The star has been here supposed to be bisected by the wire; but if the wire be a tangent to it, allowance must be made for the breadth of the wire, provided the adjustment be made for the coincidence of the wires. In observing the diameters of the sun, moon, or planets, it may perhaps be most convenient to make use of the outer edges of the wires, because they appear most distinct when quite within the limb: but if there should be any sensible inflection of the rays of light in passing by the wires, it will be best avoided by using the inner edge of one wire and the outward edge of the other; for by that means the inflection at both limbs will be the same way, and therefore there will be no alteration of the relative position of the rays passing by each wire. And it will be convenient in the micrometer to note at what division the index stands when the moveable wire coincides with H O R; for then you need not bring the wire when a star is upon it up to H O R, only reckon from the division at which the index then stands to the above division.

With a micrometer therefore thus adapted to a telescope, Mr Servington Savery of Exeter proposed a new way of measuring the difference between the greatest and least apparent diameters of the sun, although the whole of the sun was not visible in the field of view at once. The method we shall briefly describe. Place two object-glasses instead of one, so as to form two images whose limbs shall be at a small distance from each other; or instead of two perfect lenses, he proposed to cut a single lens into four parts of equal breadths by parallel lines, and to place the two segments with their straight sides against each other, or the two middle frustrums with their opposite edges together; in either case, the two parts which before had a common centre and axis, have now their centres and axes separated, and consequently two images will be formed as before by two perfect lenses. Another method in reflectors was to cut the large concave reflector through the centre, and by a contrivance to turn up the outer edges whilst the straight ones remained

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mained fixed; by which means the axis of the two parts became inclined, and formed two images. Two images being formed in this manner, he proposed to measure the distance between the limbs when the diameters of the sun were the greatest and least, the difference of which would be the difference of the diameters required. Thus far we are indebted to Mr Savery for the idea of forming two images; and the admirable use to which it was afterwards applied, we shall next proceed to describe.

The divided object-glass micrometer, as now made, was contrived by the late Mr John Dollond, and by him adapted to the object-end of a reflecting telescope, and has been since by the present Mr P. Dollond his son applied with equal advantage to the end of an achromatic telescope. The principle is this: The object-glass is divided into two segments in a line drawn through the centre; each segment is fixed in a separate frame of brass which is moveable, so that the centres of the two segments may be brought together by a handle for that purpose, and thereby form one image of an object; but when separated they will form two images, lying in a line passing through the centre of each segment; and consequently the motion of each image will be parallel to that line, which can be thrown into any position by the contrivance of another handle to turn the glass about in its own plane. The brass-work carries a vernier to measure the distance of the centres of the two segments. Now let E and H be the centres of the two segments, F their principal focus, and P Q two distant objects in FE, FH, produced, or the opposite limbs of the same object PBQD; then the images of P and Q formed by each segment, or the images of the opposite limbs of the object PBQD, coincide at F: hence two images *m z* F, *nx* F of that object are formed, whose limbs are in contact; therefore the angular distance of the points P and Q is the same as the angle which the distance E H subtends at F, which, as the angles supposed to be measured are very small, will vary as EH extremely nearly; and consequently if the angle corresponding to one interval of the centres of the segments be known, the angle corresponding to any other will be found by proportion. Now to find the interval for some one angle, take the horizontal diameter of the sun on any day, by separating the images till the contrary limbs coincide, and read off by the vernier the interval of their centres, and look into the nautical almanac for the diameter of the sun on that day, and you have the corresponding angle. Or if greater exactness be required than from taking the angle in proportion to the distances of their centres, we may proceed thus:—Draw FG perpendicular to EH, which therefore bisects it; then one half EH, or EG, is the tangent of half the angle EFH; hence, half the distance of their centres: tangent of half the angle corresponding to that distance :: half any other distance of the centres: tangent of half the corresponding angle (A).

Fig. 3.

Hence the method of measuring small angles is manifest; for we consider P, Q, either as two objects whose images are brought together by separating the two segments, or as the opposite limbs of one object PBQA, whose images, formed by the two segments E, H, touch at F: in the former case, EH gives the angular distance of the two objects; and in the latter, it gives the angle under which the diameter of the object appears. Hence, to find the angular distance of two objects, separate the segments till the two images which approach (B) each other coincide; and to find the diameter of an object, separate the segments till the contrary limbs of the images touch each other, and read off the distance of the centres of the segments from the vernier (C), and find the angle as directed in the last article. From hence appears one great superiority in this above the wire micrometer; as, with this, any diameter of an object may be measured with the same ease and accuracy; whereas with that we cannot with accuracy measure any diameter, except that which is at right angles to its apparent motion.

But, besides these two uses to which the instrument seems so well adapted, Dr Maskelyne has shown, in the Philosophical Transactions for the year 1771, how it may be applied to find the difference of right ascensions and declinations. For this purpose, two wires at right angles to each other, bisecting the field of view must be placed in the principal focus of the eye-glass, and moveable about in their own plane.—Let

(A) If the object be not a distant one, let *f* be the principal focus; then F*f*: FG :: FG : FK (FG being produced to meet a line joining the apparent places of the two objects P, Q), ∴ dividendo, *f*G : FG :: GK : FK, and alternando, *f*G : GK :: FG : FK :: (by similar triangles) EH : PQ, hence $\frac{EH}{fG}=\frac{PQ}{GK}$, therefore the angle subtended by EH at *f* = the angle subtended by PQ at G; and consequently, as G is constant, the angle measured at G is, in this case also in proportion to EH. The instrument is not adapted to measure the angular distance of bodies, one of which is near and the other at a distance, because their images would not be formed together.

(B) Besides these two images, there will be two others receding from each other, for each segment gives an image of each object.

(C) To determine whether there be any error of adjustment of the micrometer scale, measure the diameter of any small well defined object, as Jupiter's equatorial diameter, or the longest axis of Saturn's ring, both ways, that is, with o on the vernier to the right and left of o on the scale, and half the difference is the error required; which must be added to or subtracted from all observations, according as the diameter measured with o on the vernier, when advanced on the scale, is less or greater than the diameter measured the other way. And it is also evident, that half the sum of the diameters thus measured gives the true diameter of the object.

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Fig. 4.

Let HCR*c* be the field of view, HR and C*c* the two wires; turn the wires till the westernmost star (which is the best, having further to move) run along ROH; then separate the two segments and turn about the micrometer till the two images of the same star lie in the wire C*c*; and then, partly by separating the segments, and partly by raising or depressing the telescope, bring the two innermost images of the two stars to appear and run along ROH, as *a*, *b*, and the vernier will give the difference of their declinations; because, as the two images of one of the stars coincided with C*c*, the image of each star was brought perpendicularly upon HR, or to HR in their proper meridian. And, for the same reason, the difference of their times of passing the wire CO*c* will give their difference of right ascensions. These operations will be facilitated, if the telescope be mounted on a polar axis. If two other wires KL, MN, parallel to C*c*, be placed near H and R, the observation may be made on two stars whose difference of meridians is nearly equal to HR the diameter of the field of view, by bringing the two images of one of the stars to coincide with one of these wires. If two stars be observed whose difference of declinations is well settled, the scale of the micrometer will be known.

It has hitherto been supposed, that the images of the two stars can be both brought into the field of view at once upon the wire HOR: but if they cannot, set the micrometer to the difference of their declinations as nearly as you can, and make the image which comes first run along the wire HOR, by elevating or depressing the telescopes; and when the other star comes in, if it do not also run along HOR, alter the micrometer till it does, and half the sum of the numbers shown by the micrometer at the two separate observations of the two stars on the wire HOR will be the difference of their declinations. That this should be true, it is manifestly necessary that the two segments should recede equally in opposite directions; and this is effected by Mr Dollond in his new improvement of the object-glass micrometer.

The difference of right ascensions and declinations of Venus or Mercury in the sun's disk and the sun's limb may be thus found. Turn the wires so that the north limb *n* of the sun's image AB, or the north limb of the image N of the planet, may run along the wire RH, which therefore will then be parallel to the equator, and consequently C*c* a secondary to it; then separate the segments, and turn about the micrometer till the two images V*v* of the planet pass C*c* at the same time, and then by separating the segments, bring the north limb of the northermost image V of the planet to touch HR, at the time the northernmost limb *n* of the southernmost image AB of the sun touches it, and the micrometer shows the difference of declinations of the northernmost limbs of the planet and sun, for the reason formerly given †, we having brought the northernmost limbs of the two innermost, images V and AB to HR, these two being manifestly interior to *v* and the northernmost limb N of the image PQ. In the same manner we take the difference of declinations of their southernmost limbs; and half the difference of the two measures, (taking immediately one after another) is equal to the difference of the declinations of their centres, without any regard to the sun's or planet's diameters, or error of adjustment of the micrometer; for as it affects both equally, the difference is the same as if there were no error: and the difference of the times of the transits of the eastern or western limbs of the sun and planet over C *c* gives the difference of their right ascensions.

Fig. 5.

† See the preceding page col. 2. par. 2.

Instead of the difference of right ascensions, the distance of the planet from the sun's limb, in lines parallel to the equator, may be more accurately observed thus: Separate the segments, and turn about the wires and micrometer, so as to make both images V, *v*, run along HR, or so that the two intersections I, T, of the sun's image may pass C*c* at the same time. Then bring the planet's and sun's limbs into contact, as at V, and do the same for the other limb of the sun, and half the difference gives the distance of the centre of the planet from the middle of the chord on the sun's disk parallel to the equator, or the difference of the right ascensions of their centres, allowing for the motion of the planet in the interval of the observations, without any regard to the error of adjustment, for the same reason as before. For if you take any point in the chord of a circle, half the difference of the two segments is manifestly the distance of the point from the middle of the chord; and as the planet runs along HR, the chord is parallel to the equator.

Fig. 6.

In like manner, the distances of their limbs may be measured in lines perpendicular to the equator, by bringing the micrometer into the position already described*, and instead of bringing V to HR, separate the segments till the northernmost limbs coincide as at V; and in the same manner make their southernmost images to coincide, and half the difference of the two measures, allowing for the planet's motion, gives the difference of the declinations of their centres.

Fig. 7.

* See the preceding column, par. 3.

Hence the true place of a planet in the sun's disk may at any time of its transit be found; and consequently the nearest approach to the centre and the time of ecliptic conjunction may be deduced, although the middle should not be observed.

But however valuable the object-glass micrometer undoubtedly is, difficulties sometimes have been found in its use, owing to the alteration of the focus of the eye, which will cause it to give different measures of the same angle at different times. For instance, in measuring the sun's diameter, the axis of the pencil coming through the two segments from the contrary limbs of the sun, as PF, QF, fig. 3. crossing one another in the focus F under an angle equal to the sun's semidiameter, the union of the limbs cannot appear perfect, unless the eye be disposed to see objects distinctly at the place where the images are formed; for if the eye be disposed to see objects nearer to or further off than that place, in the latter case the limbs will appear separated, and the former they will appear to lap over (D). This imperfection led Dr Maskelyne

(D) For if the eye can see distinctly an image at F, the pencils of rays, of which PF, QF are the two axes, diverging from F, are each brought to the focus on the retina at the same point; and therefore the two limbs appear

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skelyne to inquire, whether some method might not be found of producing two distinct images of the sun or any other object, by bringing the axis of each pencil to coincide, or very nearly so before the formation of the images, by which means the limbs when brought together would not be liable to appear separated from any alteration of the eye; and this he found would be effected by the refraction of two prisms, placed either without or within the telescope; and on this principle, placing the prisms within, he constructed a new micrometer, and had one executed by Mr Dollond which upon trial answered as he expected. The construction is as follows.

Fig. 8, 9. Let AB be the object glass; *ab* the image, suppose of the sun, which would have been formed in the principal focus Q; but let the prisms PR, SR be placed to intercept the rays, and let EF, WG, be two rays proceeding from the eastern and western limbs of the sun, converging, after refraction at the lens, to *a* and *b*; and suppose the refraction of the prisms to be such, that in fig. 8, the ray EFR, after refraction at R by the prism PR, may proceed in the direction RQ; and as all the rays which were proceeding to *a* suffer the same refraction at the prism, they will all be refracted to Q; and therefore instead of an image *ab*, which would have been formed by the lens alone, an image Q*c* is formed by those rays which fall on the prism PR; and for the same reason the rays falling on the prism SR will form an image Q*d*: and in fig. 9. the image of the point *b* is brought to Q, by the prism PR; and consequently an image Q*d* is formed by those rays which fall on PR: and for the same reason, an image Q*c* is formed by the rays falling on SR. Now in both cases, as the rays EFR, WGR, coming from the two opposite limbs of the sun, and forming the point of contact of the two limbs, proceed in the same direction RQ, they must thus accompany each other through the eye-glass and also through the eye, whatever refractive power it has, and therefore to every eye the images must appear to touch. Now the angle *a*R*b* is twice the refraction of the prism, and the angle *a*C*b* is the diameter of the sun; and as these angles are very small, and have the same subtense *ab*, we have the angle *a*R*b* : angle *a*C*b* : : CQ : RQ.— Now as CQ is constant, and also the angle *a*R*b*, being twice the refraction of the prism, the angle *a*C*b*, varies as RQ. Hence the extent of the scale for measuring angles becomes the focal length of the object glass, and the angle measured is in proportion to the distance of the prisms from the principal focus of the object glass; and the micrometer can measure all angles (very small ones excepted, for the reason afterwards given *) which do not not exceed the sum of the refraction of the prisms; for the angle *a*C*b*, the diameter of the object to be measured, is always *less* than the angle *a*R*b*, the sum of the refractions of the prisms, except when the prisms touch the object glass, and then they become *equal*. The scale can never be out of adjustment, as the point o where the measurement begins answers to the focus of the object glass, which is a fixed point for all distant objects, and we have only to find the value of the scale answering to some known angle: for instance, bring the two limbs of the sun's images into contact, and measure the distance of the prisms from the focus, and look in the nautical almanac for the sun's diameter, and you get the value of the scale.

* Next col. par. 1 st.

In fig. 8. the limb Q, of the image Q*c*, is illuminated by the rays falling on the object glass between A and F, and of the image Q*d* by those falling between B and G; but in fig. 9. the same limbs are illuminated by the rays falling between B and F, A and G respectively, and therefore will be more illuminated than in the other case; but the difference is not considerable in achromatic telescopes, on account of the great aperture of the object-glass compared with the distance FG.

It might be convenient to have two sets of prisms, one for measuring angles not exceeding 3′, and therefore fit for measuring the diameters of the sun and moon, and the lucid parts and distances of the cusps in their eclipses; and another for measuring angles not much greater than 1′, for the conveniency of measuring the diameter of the planets. For as QC : QR : : sum of the refractions of the prisms : angle *a*C*b*, the apparent diameter of the object, it is evident that if you diminish the third term, you must increase the second in the same ratio, in order to measure the same angle; and thus by diminishing the refractive angle of the prisms, you throw them farther from Q, and consequently avoid the inconvenience of bringing them near to Q, for the reason in the next paragraph; and at the same time you will increase the illumination in a small degree. The prisms must be achromatic, each composed of two prisms of flint and crown glass, placed with their refracting angles contrariways, otherwise the images will be coloured.

In the construction here described, the angle measured becomes evanescent when the prisms come to the principal focus of the object glass, and therefore o on the scale then begins: but if the prisms be placed in the principal focus they can have no effect, because the pencil of rays at the junction of the prisms would then vanish, and therefore it is not practicable to bring the two images together to get o on the scale. Dr Maskelyne, therefore, thought of placing another pair of prisms within, to refract the rays *before* they came to the other prisms, by which means the two images would be formed into one before they came to the principal focus, and therefore o on the scale could be determined. But to avoid the error arising from the multiplication of medium, he, instead of adding another pair of prisms, divided the object glass through its centre, and sliding the segments a little it separated the images, and then by the prisms he could form one image very distinctly, and consequently could determine o on the scale; for by separating the two segments you form two images, and you will separate the two pencils so that you may move up the two prisms, and the two pencils will fall on each respectively, and the two images may be formed into one. In the instrument which Dr Maskelyne had made, o on the scale was chosen to be about $\frac{2}{3}$ of the focal length of the object-glass,

appear to coincide: but if we increase the refractive power of the eye, then each pencil is brought to a focus, and they cross each other before the rays come to the retina, consequently the two limbs on the retina will lap over; and if we diminish the refractive power of the eye, then each pencil being brought to a focus beyond the retina, and not crossing till after they have passed through it, the two limbs on the retina must be separated.

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glass, and each prism refracted 27′. By this means all angles are measured down to 0.

In the Philosophical Transactions for 1779, Mr Ramsden has described two new micrometers, which he contrived with a view of remedying the defects of the object-glass micrometer.

1. One of these is a *catoptric* micrometer, which beside the advantage it derives from the principle of reflection, of not being disturbed by the heterogeneity of light, avoids every defect of other micrometers, and can have no aberration, nor any defect arising from the imperfection of materials or of execution; as the extreme simplicity of its construction requires no additional mirrors or glasses to those required for the telescope; and the separation of the image being effected by the inclination of the two specula, and not depending on the focus of any lens or mirror, any alteration in the eye of an observer cannot affect the angle measured. It has peculiar to itself the advantages of an adjustment, to make the images coincide in a direction perpendicular to that of their motion; and also of measuring the diameter of a planet on both sides of the zero, which will appear no inconsiderable advantage to observers who know how much easier it is to ascertain the contact of the external edges of two images than their perfect coincidence.

Fig. 10. A represents the small speculum divided into two equal parts; one of which is fixed on the end of the arm B; the other end of the arm is fixed on a steel axis X, which crosses the end of the telescope C. The other half of the mirror A is fixed on the arm D, which arm at the other end terminates in a socket *y*, that turns on the axis X; both arms are prevented from bending by the braces *a a*. G represents a double screw, having one part *e* cut into double the number of threads in an inch to that of the part *g*: the part *e* having 100 threads in one inch, and the part *g* 50 only. The screw *e* works in a nut F in the side of the telescope, while the part *g* turns in a nut H, which is attached to the arm B; the ends of the arms B and D, to which the mirrors are fixed, are separated from each other by the point of the double screw pressing against the stud *h*, fixed to the arm D, and turning in the nut H on the arm B. The two arms B and D are pressed against the direction of the double screw *e g* by a spiral spring within the part *n*, by which means all shake or play in the nut H, on which the measure depends, is entirely prevented.

From the difference of the threads on the screw at *e* and *g*, it is evident, that the progressive motion of the screw through the nut will be half the distance of the separation of the two halves of the mirror; and consequently the half mirrors will be moved equally in contrary directions from the axis of the telescope C.

The wheel V fixed on the end of the double screw has its circumference divided into 100 equal parts, and numbered at every fifth division with 5, 10, &c. to 100, and the index I shows the motion of the screw with the wheel round its axis, while the number of revolutions of the screw is shown by the divsions on the same index. The steel screw at R may be turned by the key S, and serves to incline the small mirror at right angles to the direction of its motion. By turning the finger-head T (fig. 11.), the eye-tube P is brought nearer or farther from the small mirror, to adjust the telescope to distinct vision; and the telescope itself hath a motion round its axis for the conveniency of measuring the diameter of a planet in any direction. The inclination of the diameter measured with the horizon is shown in degrees and minutes by a level and vernier on a graduated circle, at the breech of the telescope.

"It is necessary to observe (says Mr Ramsden), that, besides the table for reducing the revolutions and parts of the screw to minutes, seconds, &c. it may require a table for correcting a very small error which arises from the excentric motion of the half-mirrors. By this motion their centres of curvature will (when the angle to be measured is large) approach a little towards the large mirror: the equation for this purpose in small angles is insensible; but when angles to be measured exceed ten minutes, it should not be neglected. Or, the angle measured may be corrected by diminishing it in the proportion the versed sine of the angle measured, supposing the eccentricity radius, bears to the focal length of the small mirror."

Mr Ramsden preferred Cassegrain's construction of the reflecting telescope to either the Gregorian or Newtonian, because in the former, errors caused by one speculum are diminished by those in the other. From a property of the reflecting telescope (which, he observes, has not been attended to), that the apertures of the two specula are to each other very nearly in the proportion of their focal lengths, it follows that their abberrations will be to each other in the same proportion; and these abberations in the same direction, if the two specula are both concave; or in contrary directions, if one speculum is concave and the other convex. In the Gregorian construction both specula being concave, the aberration at the second image will be the sum of the abberrations of the two mirrors; but in the Cassegrain construction, one mirror being concave and the other convex, the abberration at the second image will be the difference between their abberrations. By assuming such proportions for the *foci* of the specula as are generally used in the reflecting telescope, which is about as 1 to 4, the abberration in the Cassegrain construction will be to that in the Gregorian as 3 to 5.

2. The other is a *dioptric* micrometer, or one suited to the principles of refraction. This micrometer is applied to the erect eye-tube of a refracting telescope, and is placed in the conjugate focus of the first eye-glass: in which position, the image being considerably magnified before it comes to the micrometer, any imperfection in its glass will be magnified only by the remaining eye-glasses, which in any telescope seldom exceeds five or six times. By this position also the size of the micrometer glass will not be the $\frac{1}{100}$ part of the area which would be required if it was placed in the object-glass; and, notwithstanding this great disproportion of size, which is of great moment to the practical optician, the same extent of scale is preserved, and the images are uniformly bright in every part of the field of the telescope.

Plate CCXCVI. Fig. 12. represents the glasses of a refracting telescope; *xy*, the principal pencil of rays from the object-glass O; *t t* and *u u*, the axis of two oblique pencils; *a*, the first eye-glass; *m*, its conjugate focus, or the

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place of the micrometer; *b* the second eye-glass; *c* the third; and *d* the fourth, or that which is nearest the eye. Let *p* be the diameter of the object-glass, *e* the diameter of a pencil at *m*, and *f* the diameter of the pencil at the eye; it is evident, that the axis of the pencils from every part of the image will cross each other at the point *m*; and *e*, the width of the micrometer-glass, is to *p* the diameter of the object glass as *m a* is to *g o*, which is the proportion of the magnifying power at the point *m*; and the error caused by an imperfection in the micrometer glass placed at *m* will be to the error, had the micrometer been at O, as *m* is to *p*.

Fig. 13. represents the micrometer: A, a convex or concave lens divided into two equal parts by a plane across its centre; one of these semilenses is fixed in a frame B, and the other in the frame E; which two frames slide on a plate H, and are pressed against it by thin plates *a a*: the frames B and E are moved in contrary directions by turning the button D; L is a scale of equal parts on the frame B; it is numbered from each end towards the middle with 10, 20, &c. There are two verniers on the frame E, one at M and the other at N, for the convenience of measuring the diameter of a planet, &c. on both sides the zero. The first division on both of these verniers coincides at the same time with the two zeros on the scale L; and if the frame is moved towards the right, the relative motion of the two frames is shown on the scale L by the vernier M; but if the frame B be moved towards the left, the relative motion is shown by the vernier N.—This micrometer has a motion round the axis of vision, for the convenience of measuring the diameter of a planet, &c. in any direction, by turning an endless screw F; and the inclination of the diameter measured with the horizon is shown on the circle *g* by a vernier on the plate V. The telescope may be adjusted to distinct vision by means of an adjusting screw, which moves the whole eye-tube with the micrometer nearer or farther from the object-glass, as telescopes are generally made; or the same effect may be produced in a better manner, without moving the micrometer, by sliding the part of the eye tube *m* on the part *n*, by help of a screw or pinion. The micrometer is made to take off occasionally from the eye tube, that the telescope may be used without it.

Still, however micrometers remained in several respects imperfect. In particular, the imperfections of the parallel-wire micrometer in taking the distance of very close double stars, are the following.

When two stars are taken between the parallels, the diameters must be included. Mr Herschel informs us, he has in vain attempted to find lines sufficiently thin to extend them across the centres of the stars so that their thickness might be neglected. The single threads of the silk worm, with such lenses as he uses, are so much magnified that their diameter is more than that of many of the stars. Besides, if they were much less than they are the power of deflection of light would make the attempt to measure the distance of the centres this way fruitless: for he has always found the light of the stars to play upon those lines and separate their apparent diameters into two parts. Now since the spurious diameters of the stars thus included, as Mr Herschel assures us, are continually changing according to the state of the air, and the length of time we look at them, we are, in some respect, left at an uncertainty, and our measures taken at different times and with different degrees of attention, will vary on that account. Nor can we come at the true distance of the centres of any two stars, one from another, unless we could tell what to allow for the semidiameters of the stars themselves; for different stars have different apparent diameters, which, with a power of 227, may differ from each other as far as two seconds.

The next imperfection is that which arises from a deflection of light upon the wires when they approach very near to each other; for if this be owing to a power of repulsion lodged at the surface, it is easy to understand, that such powers must interfere with each other, and give the measures larger in proportion than they would have been if the repulsive power of one wire had not been opposed by a contrary power of the other wire.

Another very considerable imperfection of these micrometers is a continual uncertainty of the real zero. Mr Herschel has found, that the least alteration in the situation and quantity of light will affect the zero, and that a change in the position of the wires, when the light and other circumstances remain unaltered, will also produce a difference. To obviate this difficulty whenever he took a measure that required the utmost accuracy, his zero was always taken immediately after, while the apparatus remained in the same situation it was in when the measure was taken; but this enhances the difficulty, because it introduces an additional observation.

The next imperfection, which is none of the smallest, is that every micrometer that has hitherto been in use requires either a screw, or a divided bar and pinion to measure the distance of the wires or divided image. Those who are acquainted with works of this kind are but too sensible how difficult it is to have screws that shall be perfectly equal in every thread or revolution of each thread; or pinions and bars that shall be so evenly divided as perfectly to be depended upon in every leaf and tooth to perhaps the two, three, or four thousandth part of an inch: and yet, on account of the small scale of those micrometers, these quantities are of the greatest consequence; an error of a single thousandth part inducing in most instruments a mistake of several seconds.

The last and greatest imperfection of all is that these wire micrometers require a pretty strong light in the field of view; and when Mr Herschel had double stars to measure, one of which was very obscure, he was obliged to be content with less light than is necessary to make the wires perfectly distinct; and several stars on this account could not be measured at all, though otherwise not too close for the micrometer.

Mr Herschel, therefore, having long had much occasion for micrometers that would measure exceeding small distances exactly, was led to bend his attention to the improvement of these instruments; and the result of his endeavours has been a very ingenious instrument called a *lamp-micrometer*, which is not only free from the imperfections above specified, but also possesses the advantages of a very large scale. This instrument is described in the Philosophical Transactions for 1782; and the construction of it is as follows:

ABGCFE

Micrometer.

ABGCFE (fig. 14.) is a ſtand nine feet high, upon which a ſemicircular board *qhogp* is moveable upwards or downwards, in the manner of ſome fire-ſcreens as occaſion may require, and is held in its ſituation by a peg *p* put into any one of the holes of the upright piece A B. This board is a ſegment of a circle of fourteen inches radius, and is about three inches broader than a ſemicircle, to give room for the handles *r* D, *e* P, to work. The uſe of this board is to carry an arm L, thirty inches long, which is made to move upon a pivot at the centre of the circle, by means of a ſtring, which paſſes in a groove upon the edge of the ſemicircle *pgohq*; the ſtring is faſtened to a hook at *o* (not expreſſed in the figure, being at the back of the arm L), and paſſing along the groove from *oh* to *q* is turned over a pully at *q*, and goes down to a ſmall barrel *e*, within the plane of the circular board where a double-jointed handle *e* P commands its motion. By this contrivance, we ſee, the arm L may be lifted up to any altitude from the horizontal poſition to the perpendicular, or be ſuffered to deſcend by its own weight below the horizontal to the reverſe perpendicular ſituation. The weight of the handle P is ſufficient to the keep the arm in any given poſition; but if the motion ſhould be too eaſy, a friction ſpring applied to the barrel will moderate it at pleaſure.

In front of the arm L a ſmall ſlider, about three inches long, is moveable in a rabbet from the end L towards the centre backwards and forwards. A ſtring is faſtened to the left ſide of the little ſlider, and goes towards L, where it paſſes round a pully at *m*, and returns under the arm from *m*, *n*, towards the centre where it is led in a groove on the edge of the arm, which is of a circular form, upwards to a barrel (raiſed above the plane of the circular board) at *r*, to which the handle *r* D is faſtened. A ſecond ſtring is faſtened to the ſlider, at the right ſide, and goes towards the centre, where it paſſes over a pully *n*; and the weight *w*, which is ſuſpended by the end of this ſtring, returns the ſlider towards the centre, when a contrary turn of the handle permits it to act.

By *a* and *b* are repreſented two ſmall lamps, two inches high, 1 ½ in breadth by 1 ¼ in depth. The ſides back, and top, are made ſo as to permit no light to be ſeen, and the front conſiſts of a thin braſs ſliding-door. The flame in the lamp *a* is placed three-tenths of an inch from the left ſide, three-tenths from the front, and half an inch from the bottom. In the lamp *b* it is placed at the ſame height and diſtance, meaſuring from the right ſide. The wick of the flame conſiſts only of a ſingle very thin lamp cotton thread; for the ſmalleſt flame being ſufficient, it is eaſier to keep it burning in ſo confined a place. In the top of each lamp muſt be a little ſlit lengthways, and alſo a ſmall opening in one ſide near the upper part, to permit air enough to circulate to feed the flame. To prevent every reflection of light, the ſide opening of the lamp *a* ſhould be to the right, and that of the lamp *b* to the left. In the ſliding door of each lamp is made a ſmall hole with the point of a very fine needle juſt oppoſite the place where the wicks are burning, ſo that when the ſliders are ſhut down, and every thing dark, nothing ſhall be ſeen but two fine lucid points of the ſize of two ſtars of the third or fourth magnitude. The lamp *a* is placed ſo that its lucid point may be in the centre of the circular board where it remains fixed. The lamp *b* is hung to the little ſlider which moves in the rabbet of the arm, ſo that its lucid point, in an horizontal poſition of the arm, may be on a level with the lucid point in the centre. The moveable lamp is ſuſpended upon a peice of braſs faſtened to the ſlider by a pin exactly behind the flame, upon which it moves as a pivot. The lamp is balanced at the bottom by a leaden weight, ſo as always to remain upright, when the arm is either lifted above or depreſſed below the horizontal poſition. The double-jointed handles *r*D, *e*P, conſiſt of light deal rods, ten feet long, and the loweſt of them may have diviſions, marked upon it near the end P, expreſſing exactly the diſtance from the central lucid point in feet, inches, and tenths.

From this conſtruction we ſee, that a perſon at a diſtance of ten feet may govern the two lucid points, ſo as to bring them into any required poſition ſouth or north preceding or following from 0 to 90° by uſing the handle P, and alſo to any diſtance from ſix-tenths of an inch to five or ſix and twenty inches by means of the handle D. If any reflection or appearance of light ſhould be left from the top or ſides of the lamps, a temporary ſcreen, conſiſting of a long piece of paſteboard, or a wire frame covered with black cloth, of the length of the whole arm, and of any required breadth, with a ſlit of half an inch broad in the middle may be affixed to the arm by four bent wires projecting an inch or two before the lamps, ſituated ſo that the moveable lucid point may paſs along the opening left for that purpoſe.

Fig. 15. repreſents part of the arm L, half the real ſize; S the ſlider; *m*, the pulley, over which the cord *xtyz* is returned towards the centre; *w* the other cord going to the pully *n* of fig. 14. R the braſs piece moveable upon the pin *c*, to keep the lamp upright. At R is a wire rivetted to the braſs piece, upon which is held the lamp by a nut and ſcrew. Fig. 16. 17. repreſent the lamps *a*, *b*, with the ſliding doors open, to ſhow the ſituation of the wicks. W is the leaden weight with a hole *d*, in it, through which the wire R of fig. 15. is to be paſſed when the lamp is to be faſtened to the ſlider S. Fig. 18. repreſents the lamp *a* with the ſliding door ſhut; *l* the lucid point; and *ik* the openings at the top, and *s* at the ſides, for the admiſſion of air.

"Every ingenious artiſt (ſays Mr Herſchel) will ſoon perceive, that the motions of this micrometer are capable of great improvement by the application of wheels and pinions, and other well known mechanical reſources; but as the principal object is only to be able to adjuſt the two lucid points to the required poſition and diſtance, and to keep them there for a few minutes, while the obſerver goes to meaſure their diſtance, it will not be neceſſary to ſay more upon the ſubject.

"I am now to ſhow the application of this inſtrument. It is well known to opticians and others who have been in the habit of uſing optical inſtruments, that we can with one eye look into a microſcope or teleſcope, and ſee an object much magnified, while the naked eye may ſee a ſcale upon which the magnified picture is thrown. In this manner I have generally determined the power of my teleſcopes; and any one who has acquired a facility of taking ſuch obſervations will

Micrometer.

wi l very ſeldom miſtake ſo much as one in fifty in determining the power of an inſtrument, and that degree of exactneſs is fully ſufficient for the purpoſe.

"The Newtonian form is admirably adapted to the uſe of this micrometer; for the obſerver ſtands always erect, and looks in a horizontal direction, notwithſtanding the teleſcope ſhould be elevated to the zenith. Beſides, his face being turned away from the object to which his teleſcope is directed, this micrometer may be placed very conveniently without cauſing the leaſt obſtruction to the view: therefore, when I uſe this inſtrument, I put it at ten feet diſtance from the left eye, in a line perpendicular to the tube of the teleſcope, and raiſe the moveable board to ſuch a height that the lucid point of the central lamp may be upon a level with the eye. The handles, lifted up, are paſſed through two loops faſtened to the tube, juſt by the obſerver, ſo as to be ready for his uſe. I ſhould obſerve, that the end of the tube is cut away, ſo as to leave the left eye entirely free to ſee the whole micrometer.

"Having now directed the teleſcope to a double ſtar, I view it with the right eye, and at the ſame time with the left ſee it projected upon the micrometer: then, by the handle P, which commands the poſition of the arm, I raiſe or depreſs it ſo as to bring the two lucid points to a ſimilar ſituation with the two ſtars; and, by the handle D, I approach or remove the moveable lucid point to the ſame diſtance of the two ſtars, ſo that the two lucid points may be exactly covered by or coincide with the ſtars. A little practice in this buſineſs ſoon makes it eaſy, eſpecially to one who has already been uſed to look with both eyes open.

"What remains to be done is very ſimple. With a proper rule, divided into inches and fortieth parts. I take the diſtance of the lucid points, which may be done to the greateſt nicety, becauſe, as I obſerved before, the little holes are made with the point of a very fine needle. The meaſure thus obtained is the tangent of the magnified angle under which the ſtars are ſeen to a radius of ten feet; therefore, the angle being found and divided by the power of the teleſcope gives the real angular diſtance of the centres of a double ſtar.

"For inſtance, September 25, 1781, I meaſured α Hercules with this inſtrument. Having cauſed the two lucid points to coincide exactly with the ſtars centre upon centre, I found the radius or diſtance of the central lamp from the eye 10 feet 4.15 inches; the tangent or diſtance of the two lucid points 50.6 fortieth parts of an inch; this gives the magnified angle 35′, and dividing by the power 460, which I uſed, we obtain 4″ 34‴ for the diſtance of the centres of the two ſtars. The ſcale of the micrometer at this very convenient diſtance with the power of 460, (which my teleſcope bears ſo well upon the fixed ſtars that for near a twelvemonth paſt I have hardly uſed any other), is above a quarter of an inch to a ſecond; and by putting on my power of 932, which in very fine evenings is extremely diſtinct, I obtain a ſcale of more than half an inch to a ſecond, without increaſing the diſtance of the micrometer; whereas the moſt perfect of my former micrometers, with the ſame inſtrument, had a ſcale of leſs than the two thouſandth part of an inch to a ſecond.

"The meaſures of this micrometer are not confined to double ſtars only, but may be applied to any other objects that require the utmoſt accuracy, ſuch as the diameters of the planets or their ſatellites, the mountains of the moon, the diameters of the fixed ſtars, &c.

"For inſtance, October 22. 1781, I meaſured the apparent diameter of α Lyræ; and judging it of the greateſt importance to increaſe my ſcale as much as convenient, I placed the micrometer at the greateſt convenient diſtance, and (with ſome trouble, for want of longer handles, which might eaſily be added) took the diameter of this ſtar by removing the two lucid points to ſuch a diſtance as juſt to encloſe the apparent diameter. When I meaſured my radius, it was found to be twenty-two feet ſix inches. The diſtance of the two lucid points was *about* three inches, for I will not pretend to *extreme* nicety in this obſervation, on account of the very great power I uſed, which was 6450. From theſe meaſures we have the magnified angle 38′ 10″: this divided by the power gives 0″.355 for the apparent diameter of α Lyræ. The ſcale of the micrometer, on this occaſion, was no leſs than 8.443 inches to a ſecond, as will be found by multiplying the natural tangent of a ſecond with the power and radius in inches.

"November 28. 1781, I meaſured the diameter of the new ſtar; but the air was not very favourable, for this ſingular ſtar was not ſo diſtinct with 227 that evening as it generally is with 460: therefore, without laying much ſtreſs upon the exactneſs of the obſervation, I ſhall only report it to exemplify the uſe of the micrometer. My radius was 35 feet 11 inches. The diameter of the ſtar, by the diſtance of the lucid points was 2.4 inches, and the power I uſed 227: hence the magnified angle is found 19′, and the real diameter of the ſtar 5″.022. The ſcale of this meaſure .474 milleſimals of an inch, or almoſt half an inch to a ſecond."

In the Philiſophical Tranſactions for 1791, a very ſimple micrometer for meaſuring ſmall angles with the teleſcope, is deſcribed by Mr Cavallo; who introduces his deſcription with the following obſervations upon the different ſorts of teleſcopical micrometers in uſe. "Theſe inſtruments may be divided into two claſſes; namely, thoſe which have not, and thoſe which have, ſome movement amongſt their parts. The micrometers of the former ſort conſiſt moſtly of fine wires or hairs, variouſly diſpoſed, and ſituated within the teleſcope, juſt where the image of the object is formed. In order to determine an angle with thoſe micrometers, a good deal of calculation is generally required. The micrometers of the other ſort, of which there is a great variety, ſome being made with moveable parallel wires, others with prims, others again with a combination of lenſes, and ſo on, are more or leſs ſubject to ſeveral inconveniencies, the principal of which are the following. 1. Their motions generally depend upon the action of a ſcrew; and of courſe the imperfections of its threads, and the greater or leſs quantity of loſt motion, which is obſervable in moving a ſcrew, eſpecially when ſmall, occaſion a conſiderable error in the menſuration of angles. 2. Their complication and bulk renders them difficultly applicable to a variety of teleſcopes, eſpecially to the pocket ones. 3. They do not meaſure the angle without ſome loſs of time, which is neceſſary to turn the ſcrew,

Micrometer.

ſcrew, or to move ſome other mechaniſm. 4. and laſtly, They are conſiderably expenſive, ſo that ſome of them coſt even more than a tolerably good teleſcope."

After having had long in view (our author informs us) the conſtruction of a micrometer which might be in part at leaſt, if not entirely, free from all thoſe objections; he, after various attempts, at laſt ſucceeded with a ſimple contrivance, which after repeated trials, has been found to anſwer the deſired end, not only from his own experience, but from that alſo of ſeveral friends, to whom it has been communicated.

This micrometer, in ſhort, conſiſts of a thin and narrow ſlip of mother-of-pearl finely divided, and ſituated in the focus of the eye-glaſs of a teleſcope, juſt where the image of the object is formed. It is immaterial whether the teleſcope be a refractor or a reflector, provided the eye-glaſs be a convex lens, and not a concave one as in the Galilean conſtruction.

The ſimpleſt way of fixing it is to ſtick it upon the diaphragm which generally ſtands within the tube and in the focus of the eye-glaſs. When thus fixed, if you look through the eye-glaſs, the diviſions of the micrometrical ſcale will appear very diſtinct, unleſs the diaphragm is not exactly in the focus; in which caſe, the micrometrical ſcale muſt be placed exactly in the focus of the eye-glaſs, either by puſhing the diaphragm backwards or forwards, when that is practicable; or elſe the ſcale may be eaſily removed from one or other ſurface of the diaphragm by the interpoſition of a circular piece of paper or card, or by a bit of wax. This conſtruction is fully ſufficient, when the teleſcope is always to be uſed by the ſame perſon; but when different perſons are to uſe it, then the diaphragm which ſupports the micrometer muſt be conſtructed ſo as to be eaſily moved backwards or forwards, though that motion needs not be greater than about a tenth or an eighth of an inch. This is neceſſary, becauſe the diſtance of the focus of the ſame lens appears different to the eyes of different perſons; and, therefore, whoever is going to uſe the teleſcope for the menſuration of any angle, muſt firſt of all unſcrew the tube which contains the eye-glaſs and micrometer from the reſt of the teleſcope, and, looking through the eye-glaſs, muſt place the micrometer where the diviſions of it may appear quite diſtinct to his eye.

In caſe that any perſon ſhould not like to ſee always the micrometer in the field of the teleſcope, then the micrometrical ſcale, inſtead of being fixed to the diaphragm, may be fitted to a circular perforated plate of braſs, wood, or even paper, which may be occaſionally placed upon the ſaid diaphragm.

Mr Cavallo has made ſeveral experiments to determine the moſt uſeful ſubſtance for this micrometer.—Glaſs, which he had ſucceſsfully applied for a ſimilar purpoſe to the compound microſcope, ſeemed at firſt to be the moſt promiſing; but it was at laſt rejected after ſeveral trials; for the diviſions upon it generally are either too fine to be perceived, or too rough; and though with proper care and attention the diviſions may be proportioned to the ſight, yet the thickneſs of the glaſs itſelf obſtructs in ſome meaſure the diſtinct view of the object. Ivory, horn, and wood, were found uſeleſs for the conſtruction of this micrometer, on account of their bending, ſwelling and contracting very eaſily; whereas mother-of-pearl is a very ſteady ſubſtance, the diviſions upon it may be marked very eaſily, and when it is made as thin as common writing paper it has a very uſeful degree of tranſparency.

Fig. 19. exhibits this micrometer ſcale, but ſhows it four times larger than the real ſize of one, which he has adapted to a three-feet achromatic teleſcope that magnifies about 84 times. It is ſomething leſs than the 24th part of an inch broad; its thickneſs is equal to that of common writing paper; and the length of it is determined by the aperture of the diaphragm, which limits the field of the teleſcope. The diviſions upon it are the 200ths of an inch, which reach from one edge of the ſcale to about the middle of it, excepting every fifth and tenth diviſion, which are longer. The divided edge of it paſſes through the centre of the field of view, though this is not a neceſſary precaution in the conſtruction of this micrometer. Two diviſions of the above deſcribed ſcale in my teleſcope are very nearly equal to one minute; and as a quarter of one of thoſe diviſions may be very well diſtinguiſhed by eſtimation, therefore an angle of one eighth part of a minute, or of $7''\frac{1}{2}$, may be meaſured with it.

When a teleſcope magnifies more, the diviſions of the micrometer muſt be more minute; and Mr Cavallo finds, that when the focus of the eye-glaſs of the teleſcope is ſhorter than half an inch, the micrometer may be divided with the 500ths of an inch; by means of which, and the teleſcope magnifying about 200 times, one may eaſily and accurately meaſure an angle ſmaller than half a ſecond. On the other hand, when the teleſcope does not magnify above 30 times, the diviſions need not be ſo minute: for inſtance, in one of Dolland's pocket teleſcopes, which when drawn out for uſe is about 14 inches long, a micrometer with the hundreths of an inch is quite ſufficient, and one of its diviſions is equal to little leſs than three minutes, ſo that an angle of a minute may be meaſured by it.

"In looking through a teleſcope furniſhed with ſuch a micrometer (ſays our author), the field of view appears divided by the micrometer ſcale, the breadth of which occupies about one-ſeventh part of the aperture; and as the ſcale is ſemitranſparent, that part of the object which happens to be behind it may be diſcerned ſufficiently well to aſcertain the diviſion, and even the quarter of a diviſion, with which its borders coincide. Fig. 20. ſhows the appearance of the field of my teleſcope with the micrometer, when directed to the title page of the Philoſophical Tranſactions, wherein one may obſerve that the thickneſs of the letter C is equal to three-fourths of a diviſion, the diameter of the O is equal to three diviſions, and ſo on.

"At firſt view, one is apt to imagine, that it is difficult to count the diviſions which may happen to cover or to meaſure an object; but upon trial it will be found, that this is readily performed; and even people who have never been uſed to obſerve with the teleſcope,

Micrometer.

ſcope, ſoon learn to meaſure very quickly and accurately with this micrometer; for ſince every fifth and tenth diviſion is longer than the reſt, one ſoon acquires the habit of ſaying, five, ten, fifteen; and then, by adding the other diviſions leſs than five, completes the reckoning. Even with a teleſcope which has no ſtand, if the object end of it be reſted againſt a ſteady place, and the other end be held by the hand near the eye of the obſerver, an object may be meaſured with accuracy ſufficient for ſeveral purpoſes, as for the eſtimation of ſmall diſtances, for determining the height of a houſe, &c.

"After having conſtructed and adapted this micrometer to the teleſcope, it is then neceſſary to aſcertain the value of the diviſions. It is hardly neceſſary to mention in this place, that though thoſe diviſions meaſure the chords of the angles, and not the angles or arches themſelves, and the chords are not as the arches, yet it has been ſhown by all the trigonometrical writers, that in ſmall angles the chords, arches, ſines, and tangents, follow the ſame proportion ſo very nearly, that the very minute difference may be ſafely neglected: ſo that if one diviſion of this micrometer is equal to one minute, we may ſafely conclude that two diviſions are equal to two minutes, three diviſions to three minutes, and ſo on. There are various methods of aſcertaining the value of the diviſions of ſuch a micrometer, they being the very ſame that are uſed for aſcertaining the value of the diviſions in other micrometers. Such are, the paſſage of an equatorial ſtar over a certain number of diviſions in a certain time; or the meaſuring of the diameter of the ſun by computation from the focal diſtance of the object and other lenſes of the teleſcope; the laſt of which however, is ſubject to ſeveral inaccuracies; but as they are well known to aſtronomical perſons, and have been deſcribed in many books, they need not be farther noticed here. However, for the ſake of workmen and other perſons not converſant in aſtronomy, I ſhall deſcribe an eaſy and accurate method of aſcertaining the value of the diviſions of the micrometer.

"Mark upon a wall or other place the length of ſix inches, which may be done by making two dots or lines ſix inches aſunder, or by fixing a ſix-inch ruler upon a ſtand; then place the teleſcope before it ſo that the ruler or ſix-inch length may be at right angles with the direction of the teleſcope, and juſt 57 feet $3\frac{1}{7}$ inches diſtant from the object glaſs of the teleſcope: this done, look through the teleſcope at the ruler or other extenſion of ſix inches, and obſerve how many diviſions of the micrometer are equal to it, and that ſame number of diviſions is equal to half a degree, or 30′; and this is all that needs be done for the required determination; the reaſon of which is becauſe an extenſion of ſix inches ſubtends an angle of 30′ at the diſtance of 57 feet $3\frac{1}{7}$ inches, as may be eaſily calculated by the rules of plane trigonometry.

"In one of Dollond's 14-inch pocket teleſcopes if the diviſions of the micrometer be the hundredths of an inch, $11\frac{1}{2}$ of thoſe diviſions will be found equal 30′, or 23 to a degree. When this value has been once aſcertained, any other angle meaſured by any other number of diviſions is determined by the rule of three. Thus, ſuppoſe that the diameter of the ſun ſeen through the ſame teleſcope, be found equal to 12 diviſions, ſay as $11\frac{1}{2}$ diviſions are to 30 minutes, ſo are 12 diviſions to $\left(\frac{12' \times 30'}{11.5}\right)$ 31′.3, which is the required diameter of the ſun.

"Notwithſtanding the facility of this calculation, a ſcale may be made anſwering to the diviſions of a micrometer, which will ſhow the angle correſponding to any number of diviſions to mere inſpection. Thus, for the above-mentioned ſmall teleſcope, the ſcale is repreſented in fig. 21. AB is a line drawn at pleaſure; it is then divided into 23 equal parts, and thoſe diviſions which repreſent the diviſions of the micrometer that are equal to one degree, are marked on one ſide of it. The line then is divided again into 60 equal parts, which are marked on the other ſide of it; and theſe diviſions repreſent the minutes which correſpond to the diviſions of the micrometer; thus the figure ſhows, that ſix diviſions of the micrometer are equal to $15\frac{1}{2}$ minutes, $11\frac{1}{4}$ diviſions are nearly equal to 29 minutes, &c. What has been ſaid of minutes may be ſaid of ſeconds alſo, when the ſcale is to be applied to a large teleſcope.

"Thus far this micrometer and its general uſe have been ſufficiently deſcribed; and mathematical perſons may eaſily apply it to the various purpoſes to which micrometers have been found ſubſervient. But as the ſimplicity, cheapneſs, and at the ſame time the accuracy of this contrivance, may render the uſe of it much more general than that of any other micrometer; and I may venture to ſay, that it will be found very uſeful in the army, and amongſt ſea-faring people, for the determination of diſtances, heights, &c.; I ſhall therefore join ſome practical rules to render this micrometer uſeful to perſons unacquainted with trigonometry and the uſe of logarithms.

"Problem I. The angle, not exceeding one degree which is ſubtended by an extenſion of one foot, being given, to find its diſtance from the place of obſervation. *N. B.* This extenſion of one foot or any other, which may be mentioned hereafter, muſt be perpendicular to the direction of the teleſcope through which it is obſerved. The diſtances are reckoned from the object-glaſs of the teleſcope; and the anſwers obtained by the rules of this problem, though not exactly tree, are however ſo little different from the truth, that the difference ſeldom amounts to more than two or three inches, which may be ſafely neglected.

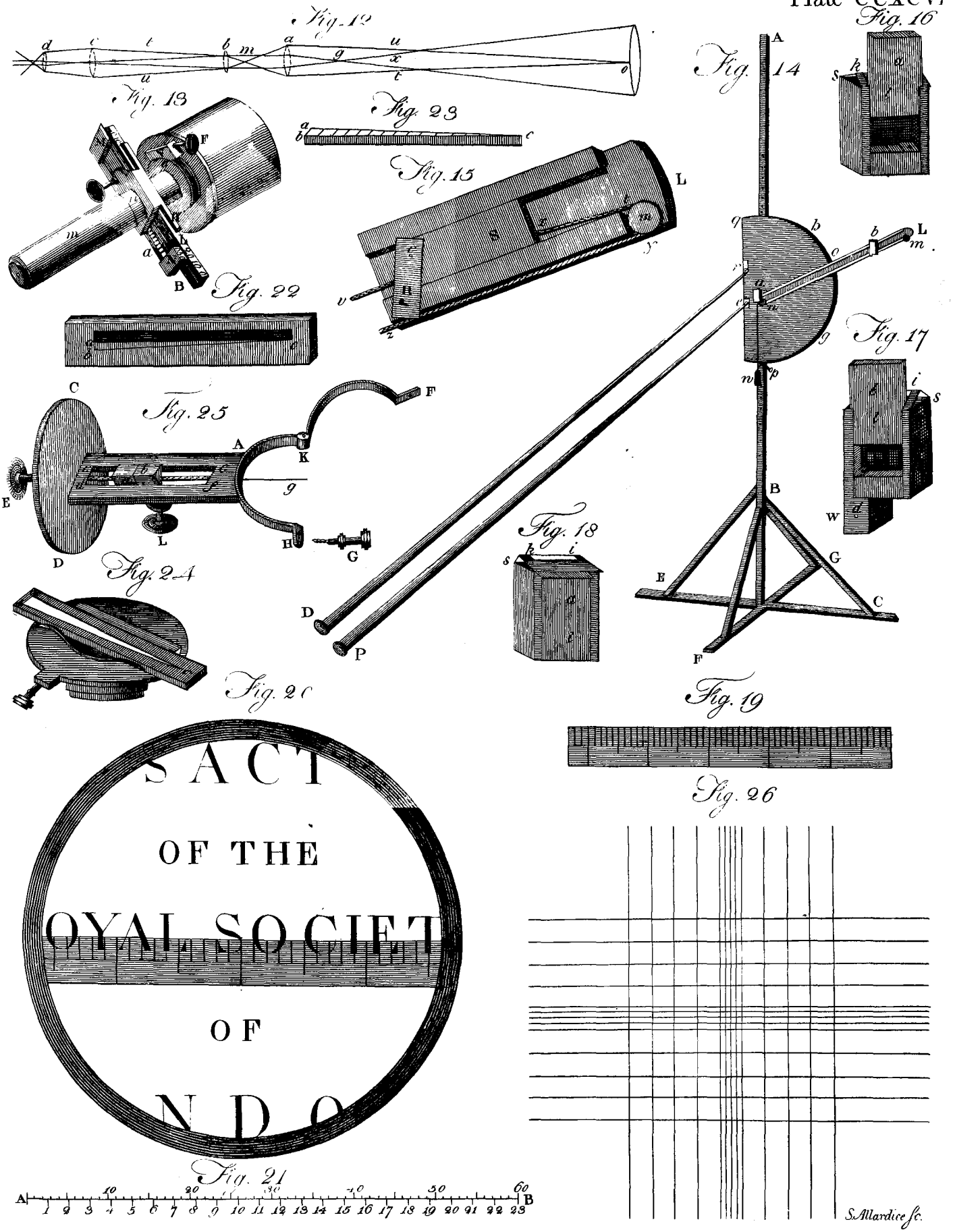
"Rule 1. If the angle be expreſſed in minutes, ſay as the given angle is to 60, ſo is 687.55 to a fourth proportional, which gives the anſwer in inches. —2. If the angle be expreſſed in ſeconds, ſay, as the given angle is to 3600, ſo is 687.55 to a fourth proportional, which expreſſes the anſwer in inches. —3. If the angle be expreſſed in minutes and ſeconds, turn it all into ſeconds, and proceed as above.

"Example. At what diſtance is a globe of one foot in diameter when it ſubtends an angle of two ſeconds?

$$2 : 3600 :: 687,55 : \frac{3600 \times 687.55}{2} = 1237590$$

inches, or $103132\frac{1}{2}$ feet which is the anſwer required.

This



Micrometer.

"This calculation may be shortened; for since two of the three proportionals are fixed, their product in the first case is 41253, and in the other two cases is 2475180; so that in the first case, viz. when the angle is expressed in minutes, you need only divide 41253 by the given angle; and in the other two cases, viz. when the angle is expressed in seconds, divide 2475180 by the given angle, and the quotient in either case is the answer in inches.

"Problem II. The angle, not exceeding one degree, which is subtended by any known extension, being given, to find its distance from the place of observation.

"Rule. Proceed as if the extension were of one foot by Problem I. and call the answer B; then, if the extension in question be expressed in inches, say, as 12 inches are to that extension, so is B to a fourth proportional, which is the answer in inches; but if the extension in question be expressed in feet, then you need only multiply it by B, and the product is the answer in inches,

"Example, At what distance is a man six feet high when he appears to subtend an angle of 30″.

"By problem I. if the man were one foot high, the distance would be 82506 inches; but as he is six feet high, therefore multiply 82506 by 6, and the product gives the required distance, which is 495036 inches, or 41253 feet.

"For greater conveniency, especially in travelling, or in such circumstances in which one has not the opportunity of making even the easy calculations required in those problems, I have calculated the following two tables; the first of which shows the distance answering to any angle from one minute to one degree, which is subtended by an extention of one foot; and the second table shows the distance answering to any angle from one minute to one degree, which is subtended by a man, the height of which has been called an extension of six feet; because at a mean, such is the height of a man when dressed with hat and shoes on. These tables may be transcribed on a card, and may be had always ready with a pocket telescope furnished with a mircometer. Their use is evidently to ascertain distances without any calculation; and they are calculated only to minutes, because with a pocket telescope and micrometer it is not possible to measure an angle more accurately than to a minute.

"Thus, if one wants to measure the extension of a street, let a foot ruler be placed at the end of the street; measure the angular appearance of it, which suppose to be 36′, and in the table you will have the required distance against 36′, which is 95½ feet. Thus also a man who appears to be 49′ high, is at the distance of 421 feet.

Angles subtended by an extension of one foot at different distances.

Angles.	Distances in feet.	Angles.	Distances in feet.
Min. 1	3437,7	Min. 31	110,9
2	1718,9	32	107,4
3	1145,9	33	104,2
4	859,4	34	101,1
5	687,5	35	98,2
6	572,9	36	95.5
7	491,1	37	92,9
8	429,7	38	90,4
9	382,0	39	88,1
10	343,7	40	85,9
11	312,5	41	83,8
12	286,5	42	81,8
13	264,4	43	79,9
14	245,5	44	78,1
15	229,2	45	76,4
16	214,8	46	74,7
17	202,2	47	73,1
18	191,0	48	71,6
19	180,9	49	70,1
20	171,8	50	68,7
21	162,7	51	67,4
22	156,2	52	66,1
23	149,4	53	64,8
24	143,2	54	63,6
25	137,5	55	62,5
26	132,2	56	61,4
27	127,3	57	60,3
28	122,7	58	59,2
29	118,5	59	58,2
30	114,6	60	57,3

Angles subtended by an extension of six feet at different distances.

Angles.	Distances in feet.	Angles.	Distances in feet.
Min. 1	20626,8	Min. 31	665,4
2	10313.	32	644,5
3	6875,4	33	625.
4	5156,5	34	606,6
5	4125,2	35	589,3
6	3437,7	36	572,9
7	2946,6	37	557,5
8	2578,2	38	542,8
9	2291,8	39	528,9
10	2062,6	40	515,6
11	1875,2	41	503,1
12	1718,8	42	491,1
13	1586,7	43	479,7
14	1473,3	44	468,8
15	1375.	45	458,4
16	1298,1	46	448,4
17	1213,3	47	438,9
18	1145,9	48	429,7
19	1085,6	49	421.
20	1031,4	50	412,5
21	982,2	51	404,4
22	937,6	52	396,7
23	896,8	53	389,2
24	859,4	54	381,9
25	825.	55	375.
26	793,3	56	368,3
27	763,9	57	361,9
28	739,6	58	355,6
29	711,3	59	349,6
30	687,5	60	343,7

Micrometer.

II. The micrometer has not only been applied to telescopes, and employed for astronomical purposes; but there have also been various contrivances for adapting it to MICROSCOPICAL observations. Mr Leeuwenhoek's method of estimating the size of small objects was by comparing them with grains of sand, of which 100 in a line took up an inch. These grains he laid upon the same plate with his objects, and viewed them at the same time. Dr Jurin's method was similar to this; for he found the diameter of a piece of fine silver wire, by wrapping it as close as he could about a pin, and observing how many rings made an inch; and he used this wire in the same manner as Leeuwenhoek used his sand. Dr Hooke used to look upon the magnified object with one eye, while at the same time he viewed other objects placed at the same distance with the other eye. In this manner he was able, by the help of a ruler, divided into inches and small parts, and laid on the pedestal of the microscope, to cast as it were the magnified appearance of the object upon the ruler, and thus exactly to measure the diameter which it appeared to have through the glass; which being compared with the diameter as it appeared to the naked eye, easily showed the degree in which it was magnified. A little practice says, Mr Baker will render this method exceedingly easy and pleasant.

Mr Martin in his Optics recommended such a micrometer for a microscope as had been applied to telescopes: for he advises to draw a number of parallel lines on a piece of glass, with the fine point of a diamond at the distance of one-fortieth of an inch from one another, and to place it in the focus of the eye-glass. By this method, Dr Smith contrived to take the exact draught of objects viewed by a double microscope for he advises to get a lattice, made with small silver wires or squares, drawn upon a plain glass by the strokes of a diamond, and to put it into the place of the image, formed by the object-glass: then by transferring the parts of the object, seen in the squares of the glass or lattice upon similar corresponding square drawn on paper, the picture may be exactly taken. Mr Martin also introduced into compound microscopes another micrometer consisting of a screw. See both these methods described in his *Optics*, p. 277.

The mode of actual admeasurement (Mr Adams observes *) is without doubt the most simple that can be used; as by it we comprehend in a manner, at one glance, the different effects of combined glasses; and as it saves the trouble, and avoids the obscurity, of the usual modes of calculation: but many persons find it exceedingly difficult to adopt this method, because they have not been accustomed to observe with both eyes at once. To obviate this inconvenience, the late Mr Adams contrived an instrument called the *Needle-Micrometer*, which was first described in his *Micrographia Illustrata*; and of which as now constructed, we have the following description by his son Mr George Adams in the ingenious Essays above quoted.

* Microscopical Essays p. 59.

This micrometer consists of a screw, which has 50 threads to an inch; this screw carries an index, which points to the divisions on a circular plate, which is fixed at right angles to the axis of the screw. The revolutions of the screw are counted on a scale which is an inch divided into 50 parts; the index to these divisions is a flower-de-luce marked upon the slider, which carries the needle point across the field of the microscope. Every revolution of the micrometer screw measures $\frac{1}{50}$ part of an inch, which is again subdivided by means of the divisions on the circular plate, as this is divided into 20 equal parts, over which the index passes at every revolution of the screw; by which means we obtain with ease the measure of 1000th part of an inch: for 50, the number of threads on the screw in one inch, being multiplied by 20, the divisions on the circular plate are equal to 1000; so that each division on the circular plate shows that the needle has either advanced or receded 1000th part of an inch.

Plate CCXCVI.

To place this micrometer on the body of the microscope, open the circular part FKH, fig. 25. by taking out the screw G, throw back the semicircle FK, which moves upon a joint at K; then turn the sliding tube of the body of the microscope, so that the small holes which are in both tubes may exactly coincide, and let the needle *g* of the micrometer have a free passage through them; after this, screw it fast upon the body by the screw G. The needle will now traverse the field of the microscope, and measure the length and breadth of the image of any object that is applied to it. But further assistance must be had, in order to measure the object itself, which is a subject of real importance; for though we have ascertained the power of the microscope, and know that it is so many thousand times, yet this will be of little assistance towards ascertaining an accurate idea of its real size; for our ideas of bulk being formed by the comparison of one object with another, we can only judge of that of any particular body, by comparing it with another whose size is known: the same thing is necessary, in order to form an estimate by the microscope; therefore to ascertain the real measure of the object, we must make the point of the needle pass over the image of a known part of an inch placed on the stage, and write down the revolutions made by the screw, while the needle passed over the image of this known measure; by which means we ascertain the number of revolutions on the screw, which are adequate to a real and known measure on the stage. As it requires an attentive eye to watch the motion of the needle point as it passes over the image of a known part of an inch on the stage, we ought not to trust to one single measurement of the image, but ought to repeat it at least six times; then add the six measures thus obtained together, and divide their sum by six, or the number of trials; the quotient will be the mean of all the trials. This result is to be placed in a column of a table next to that which contains the number of the magnifiers.

By the assistance of the sectoral scale, we obtain with ease a small part of an inch. This scale is shown at fig. 22, 23, 24, in which the two lines *ca*, *cb*, with the side *ab*, form an isosceles triangle; each of the sides is two inches long, and the base still only of one-tenth of an inch. The longer sides may be of any given length, and the base still only of one tenth of an inch. The longer lines may be considered as the line of lines upon a sector opened to one-tenth of an inch. Hence whatever number of equal parts *ca*, *cb* are divided into, their transverse measure will be such a part of one-tenth as is expressed by their divisions. Thus if it be divided into ten equal parts, this will divide the

Micrometer.

the inch into 100 equal parts; the first division next *c* will be equal to 100th part of an inch, because it is the tenth part of one tenth of an inch. If these lines are divided into twenty equal parts, the inch will be by that means divided into 200 equal parts. Lastly, if *ab*, *ca*, are made three inches long and divided into 100 equal parts, we obtain with ease the 1000th part. The scale is represented as solid at fig. 23. but as perforated at fig. 22. and 24. so that the light passes thro' the aperture, when the sectoral part is placed on the stage.

To use this scale, first fix the micrometer, fig. 25. to the body of the microscope; then fit the sectoral scale, fig. 24. in the stage, and adjust the microscope to its proper focus or distance from the scale, which is to be moved till the base appears in the middle of the field of view; then bring the needle point *g*, fig. 25. (by turning the screw L) to touch one of the lines *ca*, exactly at the point answering to 20 on the sectoral scale. The index *a* of the micrometer is to be set to the first division, and that on the dial plate to 20, which is both the beginning and end of its divisions; we are then prepared to find the magnifying power of every magnifier in the compound microscope which we are using.

Example. Every thing being prepared agreeable to the foregoing directions, suppose you are desirous of ascertaining the magnifying power of the lens marked N° 4. turn the micrometer screw until the point of the needle point traversed the magnified image of the tenth part of one inch; then the division where the two indices remain, will show how many revolutions, and parts of a revolution, the screw has made, while the needle point traversed the magnified image of the one tenth of an inch; suppose the result to be 26 revolutions of the screw, and 14 parts of another revolution, this is equal to 26 multiplied by 20, added to 14; that is, 534,000 parts of an inch.—The 26 divisions found on the straight scale of the micrometer, while the point of the needle passed over the magnified image of one-tenth part of an inch, were multiplied by 20, because the circular plate CD, fig. 25. is divided into 20 equal parts; this produced 520; then adding the 14 parts of the next revolution, we obtain the 534,000 parts of an inch, or five-tenths and 3400 parts of another tenth, which is the measure of the magnified image of one-tenth of an inch at the aperture of the eye-glasses or at their foci. Now if we suppose the focus of the two eye-glasses to be one inch, the double thereof is two inches; or if we reckon in the 1000th part of an inch, we have 2000 parts for the distance of the eye from the needle point of the micrometer. Again, if we take the distance of the image from the object at the stage at 6 inches, or 6000, and add thereto 2000, double the distance of the focus of the eye glass, we shall have 8000 parts of an inch for the distance of the eye from the objects; and as the glasses double the image, we must double the number 534 found upon the micrometer, which then makes 1068: then, by the following analogy, we shall obtain the number of times the microscope magnifies the diameter of the object; say, as 240, the distance of the eye from the image of the object, is to 800, the distance of the eye from the object; so is 1068, double the measure found on the micrometer, to 3563, or the number of times the microscope magnifies the diameter of the object. By working in this manner, the magnifying power of each lens used with the compound microscope may be easily found, though the result will be different in different compound microscopes, varying according to the combination of the lenses, their distance from the object and one another, &c.

Having discovered the magnifying power of the microscope, with the different object-lenses that are used therewith, our next subject is to find out the real size of the objects themselves, and their different parts: this is easily effected, by finding how many revolutions of the micrometer-screw answer to a known measure on the sectoral scale or other object placed on the stage; from the number thus found a table should be constructed, expressing the value of the different revolutions of the micrometer with that object-lens, by which the primary number was obtained. Similar tables must be constructed for each object lens. By a set of tables of this kind, the observer may readily find the measure of any object he is examining; for he has only to make the needle point traverse over this object, and observe the number of revolutions the screw has made in its passage, and then look into his table for the real measure which corresponds to this number of revolutions, which is the measure required.

Mr Coventry of Southwark has favoured us with the description of a micrometer of his own invention; the scale of which, for minuteness, surpasses every instrument of the kind of which we have any knowledge, and of which, indeed, we could scarcely have formed a conception, had he not indulged us with several of these instruments, graduated as underneath.

The micrometer is composed of glass, ivory, silver, &c. on which are drawn parallel lines from the 10th to the 10,000th part of an inch. But an instrument thus divided, he observes, is more for curiosity than use: but one of those which Mr Coventry has sent us is divided into squares, so small that sixteen millions of them are contained on the surface of one square inch, each square appearing under the microscope true and distinct; and though so small, it is a fact, that animalcula are found which may be contained in one of these squares.

The use of micrometers when applied to microscopes, is to measure the natural size of the object and how much that object is magnified. To ascertain the real size of an object in the single microscope, nothing more is required than to lay it on the micrometer, and adjust it to the focus of the magnifier, noticing how many divisions of the micrometer it covers. Suppose the parallel lines of the micrometer to be the 1000th of an inch, and the object covers two divisions; its real size is 500ths of an inch; if five, 200ths, and so on.

But to find how much the object is magnified, is not mathematically determined so easily by the single as by the compound microscope: but the following simple method (says Mr Coventry) I have generally adopted, and think it tolerably accurate. Adjust a micrometer under the microscope *o*, say the 100th of an inch of divisions, with a small object on it; if square, the better: notice how many divisions one side of the object covers, suppose 10: then cut a piece

Micrometer.

of white paper something larger than the magnified appearance of the object: then fix one eye on the object through the microscope, and the other at the same time on the paper, lowering it down till the object and the paper appear level and distinct; then cut the paper till it appear exactly the size of the magnified object; the paper being then measured, suppose an inch square: Now, as the object under the magnifier, which appeared to be one inch square, was in reality only ten hundredths, or the tenth of an inch, the experiment proves that it is magnified ten times in length, one hundred times in superfices, and one thousand times in cube, which is the magnifying power of the glass; and in the same manner, a table may be made of the power of all the other glasses.

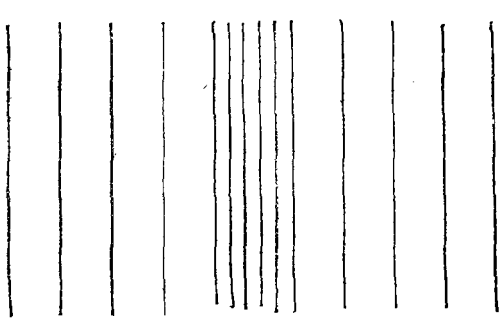
In using the compound microscope, the real size of the object is found by the same method as in the single: but to demonstrate the magnifying power of each glass to greater certainty, adopt the following method.—Lay a two-feet rule on the stage, and a micrometer level with its surface (an inch suppose, divided into 100 parts): with one eye see how many of those parts are contained in the field of the microscope, (suppose 50); and with the other, at the same time look for the circle of light in the field of the microscope, which with a little practice will soon appear distinct; mark how much of the rule is intersected by the circle of light, which will be half the diameter of the field. Suppose eight inches; consequently the whole diameter will be sixteen. Now, as the real size of the field, by the micrometers, appeared to be only 50 hundredths or half an inch, and as half an inch is only one 32d part of 16 inches, it shows the magnifying power of the glass to be 32 times in length, 1024 superfices, and 32,768 cube (E).

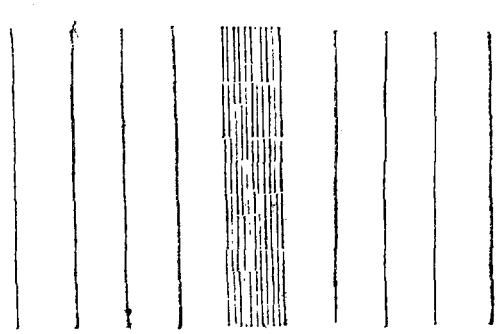
Another way of finding the magnifying power of compound microscopes, is by using two micrometers of the same divisions; one adjusted under the magnifier, the other fixed in the body of the microscope in the focus of the eye glass. Notice how many divisions of the micrometer in the body are seen in one division of the micrometer under the magnifier which again must be multiplied by the power of the eye-glass. Example: Ten divisions of the micrometer in the body are contained in one division under the magnifier; so far the power is increased ten times: now, if the eye-glass be one inch focus, such glass will of itself magnify about eight times in length, which, with the ten times magnified before, will be eight times ten, or 80 times in length, 6400 superficies and 512,000 cube.

"If (says Mr Coventry) these micrometers are employed in the solar microscope, they divide the object into squares on the screen in such a manner as to render it extremely easy to make a drawing of it. And (says he) I apprehend they may be employed to great advantage with such a microscope as Mr Adam's Lucernal; because this instrument may be used either by day or night, or in any place, and gives the actual magnifying power without calculation."

The case with which we have been favoured by Mr Coventry contains six micrometers, two on ivory and four on glass. One of those on ivory is an inch divided into one hundred parts, every fifth line longer than the intermediate one, and every tenth longer still, for the greater ease in counting the divisions under the microscope, and is generally used in measuring the magnifying power of microscopes. The other ivory one is divided into squares of the 50th and 100th of of an inch, and is commonly employed in measuring opaque objects.

Those made of the glass are for transparent objects, which, when laid on them, show their natural size.—That marked on the brass 100, are squares divided to the 100th of an inch: that marked 5000 are parallel lines forming nine divisions, each division the 1000th of an inch; the middle division is again divided into 5, making divisions to the 5000th of an inch. That marked 10,000 is divided in the same manner, with the middle division divided into 10, making the 10,000th of an inch. Example:





The glass micrometer without any mark is also divided, the outside lines into 100th, the next into 1000th, and the inside lines into the 4000th of an inch: these are again crossed with an equal number of lines in the same manner, making squares of the 100th, 1000th, and 4000th of an inch, thus demonstrating each other's size. The middle square of the 1000th of an inch (see fig. 26.) is divided into sixteen squares; now

(E) It will be necessary, for great accuracy, as well as for comparative observations, that the two feet rule should always be placed at a certain distance from the eye: eight inches would, in general, be a proper distance.

Micropus, Microscope

now as 1000 squares in the length of an inch, multiplyed by 1000, gives one million in an inch surface; by the same rule, one of those squares divided into 16 must be the sixteen millionth part of an inch surface. See fig. 26. which is a diminished view of the apparent surface exhibited under the magnifier n° 1 of Wilson's microscope. In viewing the smallest lines. Mr Coventry uses n° 2 or 3.; and they are all better seen, he says, by candle than by day-light.

MICROPUS, BASTARD CUDWEED: A genus of the polygamia necessaria order, belonging to the syngenesia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is paleaceous; there is no pappus; the calx is calyculated; there is no radius of the corolla. The female florets are wrapped in the scales of the calyx. There are two species, the supinus and erectus; but only the former is ever cultivated in gardens. It is an annual plant, growing naturally in Portugal, in places near the sea. The root sends out several trailing stalks about six or eight inches long, which are garnished with small oval, silvery leaves, whose bases embrace the stalks. The flowers come out in clusters from the wings of the stalks, and are very small, and of a white colour. It flowers in June and July; and is frequently preserved in gardens on account of the beauty of its silvery leaves. It is easily propagated by seed sown in autumn, and requires no other culture but to be kept free from weeds.

MICROSCOPE, an optical instrument, consisting of lenses, or mirrors, by means of which small objects appear larger than they do to the naked eye. *Single* microscopes consist of a single lens or mirror; or if more lenses or mirrors be made use of, they only serve to throw light upon the object, but do not contribute to enlarge the image of it. *Double* or *Compound* microscopes are those in which the image of an object is composed by means of more lenses or mirrors than one.

For the principles on which the construction of microscopes depends, see OPTICS. In the present article, it is intended to describe the finished instrument with all its varied apparatus, according to the latest improvements; and to illustrate by proper details its uses and importance.

I. *Of* SINGLE *Microscopes.*

THE famous microscopes made use of by Mr Leewenhoeck, were all, as Mr Baker assures us, of the single kind, and the construction of them was the most simple possible; each consisting only of a single lens set between two plates of silver, perforated with a small hole, with a moveable pin before it to place the object on and adjust it to the eye of the beholder. He informs us also, that lenses only, and not *globules*, were used in every one of those microscopes.

Plate CCXCVII. fig. 1.

1. The single microscope now most generally known and used is that called *Wilson's Pocket Microscope*. The body is made of brass, ivory, or silver, and is represented by AA, BB. CC is a long fine-threaded male screw that turns into the body of the microscope; D a convex glass at the end of the screw. Two concave round peices of thin brass, with holes of different diameters in the middle of them, are placed to cover the abovementioned glass, and thereby diminish the aperture when the greatest magnifiers are employed. EE, three thin plates of brass within the body of the microscope; one of which is bent semicircularly in the middle, so as to form an arched cavity for the reception of a tube of glass, the use of the other two being to receive and hold the sliders between them. F, a piece of wood or ivory, arched in the manner of the semicircular plate, and cemented to it. G, the other end of the body of the microscope, where a hollow female screw is adapted to receive the different magnifiers. H, is a spiral spring of steel, between the end G and the plates of brass, intended to keep the plates in a right position and counteract the long screw CC. I, is a small turned handle, for the better holding of the instrument, to screw on or off at pleasure.

To this microscope belong six or seven magnifying glasses: six of them are set in silver, brass, or ivory, as in the figure K; and marked 1, 2, 3, 4, 5, 6, the lowest numbers being the greatest magnifiers. L, is the seventh magnifier, set in the manner of a little barrel, to be held in the hand for the viewing of any larger object. M, is a flat slip of ivory, called a *slider*, with four round holes through it, wherein to place objects between two peices of glass or Muscovy talc, as they appear at *dddd*. Six such sliders, and one of brass, are usually sold with this microscope some with objects placed in them, and others empty for viewing any thing that may offer: but whoever pleases to make a collection, may have as many as he desires. The brass slider is to confine any small object, that it may be viewed without crushing or destroying it. N, is a tube of glass contrived to confine living objects, such as frogs, fishes, &c. in order to discover the circulation of the blood. All these are contained in a little neat box of fish-skin or mahogany, very convenient for carrying in the pocket.

When an object is to be viewed, thrust the ivory slider, in which the said object is placed, between the two flat brass plates EE: observing always to put that side of the slider where the brass rings are farthest from the eye. Then screw on the magnifying glass you intend to use, at the end of the instrument G; and looking through it against the light, turn the long screw CC, till your object be brought to suit your eye; which will be known by its appearing perfectly distinct and clear. It is most proper to look at it first through a magnifier that can show the whole at once and afterwards to inspect the several parts more particularly with one of the greatest magnifiers; for thus you will gain a true idea of the whole, and of all its parts. And though the greatest magnifiers can show but a minute portion of any object at once such as the claw of a flea, the horn of a louse, or the like; yet by gently moving the slider which contains the object the eye will gradually examine it all over.

As objects must be brought very near the glasses when the greatest magnifiers are made use of, be careful not to scratch them by rubbing the slider against them as you move it in or out. A few turns of the screw CC will easily prevent this mischief, by giving them room enough. You may change the objects in your sliders for any others you think proper, by taking out the brass rings with the point of a penknife; the talcs will then fall out, if you but turn the sliders;

and

and after putting what you pleaſe between them, by replacing the braſs rings you will faſten them as they were before. It is proper to have ſome ſliders furniſhed with talcs, but without any object between them, to be always in readineſs for the examination of fluids ſalts, ſands, powders, the farina of flowers, or any other caſual objects of ſuch ſort as need only be applied to the outſide of the talc.

The circulation of the blood may be eaſieſt ſeen in the tails or fins of fiſhes, in the fine membranes between a frog's toes, or beſt of all in the tail of a water-newt. If your object be a ſmall fiſh, place it within the tube N, and ſpread its tail or fin along the ſide thereof: if a frog, chooſe ſuch an one as can but juſt be got into your tube; and, with a pen, or ſmall ſtick, expand the tranſparent membrane between the toes of the frog's hind foot as much as you can. When your object is ſo adjuſted that no part of it can intercept the light from the place, you intend to view, unſcrew the long ſcrew CC, and thruſt your tube into the arched cavity, quite through the body of the microſcope; then ſcrew it to the true focal diſtance, and you will ſee the blood paſſing along its veſſels with a rapid motion, and in a moſt ſurpriſing manner.

The third or fourth magnifiers may be uſed for frogs or fiſhes: but for the tails of water-newts, the fifth or ſixth will do; becauſe the globules of their blood are twice as large as thoſe of frogs or fiſh. The firſt or ſecond magnifier cannot well be employed for this purpoſe; becauſe the thickneſs of the tube in which the object lies, will ſcarce admit its being brought ſo near as the focal diſtance of the magnifier.

An apparatus for the purpoſe of viewing opaque objects generally accompanies this microſcope; and which conſiſts of the following parts. A braſs arm QR, which is ſcrewed at Q, upon the body of the microſcope at G. Into the round hole R, any of the magnifiers ſuitable to the object to be viewed are to be ſcrewed; and under it, in the ſame ring, the concave poliſhed ſilver ſpeculum S. Through a ſmall aperture in the body of the microſcope under the braſs plates EE, is to ſlide the long wire with the forceps T: This wire is pointed at one of its ends; and ſo, that either the points or forceps may be uſed for the objects as may be neceſſary. It is eaſy to conceive, therefore, that the arm at R, which turns by a twofold joint at *a* and *b*, may be brought with its magnifier over the object, the light reflected upon it by the application of the ſpeculum, and the true focus obtained by turning of the male ſcrew CC as before directed.—As objects are ſometimes not well fixed for view, either by the forceps or point, the ſmall peice ſhown at N is added, and in ſuch caſes anſwers better; it ſcrews over the point of T; it contains a ſmall round piece of ivory, blackened on one ſide, and left white upon the other as a contraſt to coloured objects, and by a ſmall piece of watch-ſpring faſtens down the objects upon the ivory.

2. *Single microſcope by reflection.* In fig. 2. A is a ſcroll of braſs fixed upright upon a round wooden baſe B, or mahogany drawer or caſe, ſo as to ſtand perfectly firm and ſteady. C is a braſs ſcrew, that paſſes through a hole in the upper limb of the ſcroll into the ſide of the microſcope D, and ſcrews it faſt to the ſaid ſcroll. E is a concave ſpeculum ſet in a box of braſs, which hangs in the arch G by two ſmall ſcrews *ff*, that ſcrew into the oppoſite ſides thereof. At the bottom of this arch is a pin of the ſame metal, exactly fitted to a hole *h* in the wooden pedeſtal made for the reception of the pin. As the arch turns on this pin, and the ſpeculum turns on the end of the arch, it may, by this twofold motion, be eaſily adjuſted in ſuch a manner as to reflect the light of the ſun of the ſky, or of a candle, directly upwards through the microſcope that is fixed perpendicularly over it; and by ſo doing may be made to anſwer many purpoſes of the large double reflecting microſcope. The body of the microſcope may alſo be fixed horizontally, and objects viewed in that poſition by any light you chooſe; which is an advantage the common double reflecting microſcope has not. It may alſo be rendered further uſeful by means of a ſlip of glaſs; one end of which being thruſt through between the plates where the ſliders go, and the other extending to ſome diſtance, ſuch objects may be placed thereon as cannot be applied in the ſliders: and then having a limb of braſs that may faſten to the body of the microſcope, and extend over the projecting glaſs a hollow ring wherein to ſcrew the magnifiers, all ſorts of ſubjects may be examined with great convenience, if a hole be made in the pedeſtal, to place the ſpeculum exactly underneath, and thereby throw up the rays of light. The pocket-microſcope, thus mounted, ſays Mr Baker, "is as eaſy and pleaſant in its uſe; as fit for the moſt curious examination of the animalcules and ſalts in fluids, of the farinæ in vegetables, and of the circulation in ſmall animals; in ſhort, is as likely to make conſiderable diſcoveries in objects that have ſome degree of tranſparency, as any microſcope I have ever ſeen or heard of."

The braſs ſcroll A is now generally made to unſcrew into three parts, and pack with the microſcope and apparatus into the drawer of a mahogany pocket-caſe, upon the lid of which the ſcroll is made to fix when in uſe.

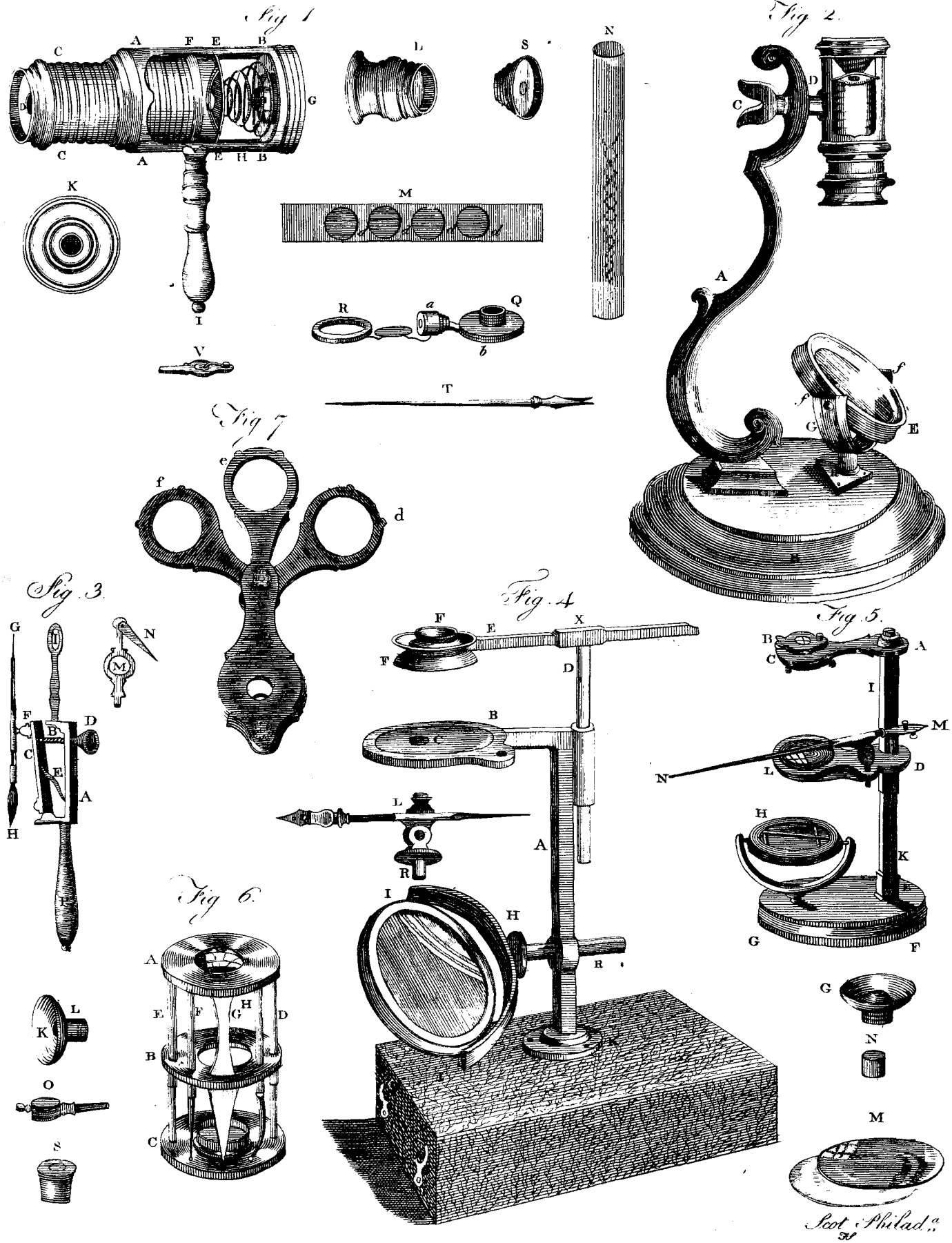
The opaque apparatus alſo, as above deſcribed, is applicable this way by reflection. It only conſiſts in turning the arm R (fig. 1.), with the magnifier over the concave ſpeculum below (fig. 2), or to receive the light as reflected obliquely from it: the ſilver ſpeculum ſcrewed into R will then reflect the light, which it receives from the glaſs ſpeculum, ſtrongly upon the object that is applied upon the wire T underneath.

This microſcope, however, is not upon the moſt convenient conſtruction, in compariſon with others now made: it has been eſteemed for many years paſt from its popular name, and recommendation by its makers. Its portability is certainly a great advantage in its favour; but in moſt reſpects it is ſuperſeded by the microſcopes hereafter deſcribed.

3. *Microſcope for Opaque Objects, called the Single Opaque Microſcope.* This microſcope remedies the inconvenience of having the dark ſide of an object next the eye, which formerly was an unſurmountable objection to the making obſervations on opaque objects with any conſiderable degree of exactneſs or ſatisfaction: for, in all other contrivances commonly known, the nearneſs of the inſtrument to the object (when glaſſes that magnify much are uſed) unavoidably overſhadows it ſo much, that its appearance is rendered obſcure and indiſtinct. And, notwithſtanding ways Fig. 3.

have

MICROSCOPE.



Microscope have been tried to point light upon an object, from the sun or a candle, by a convex glass placed on the side thereof, the rays from either can be thrown upon it in such an acute angle only, that they serve to give a confused glare, but are insufficient to afford a clear and perfect view of the object. But this microscope, by means of a concave speculum of silver highly polished in whose centre a magnifying lens is placed, such a strong and direct light is reflected upon the object, that it may be examined with all imaginable ease and pleasure. The several parts of this instrument, made either of brass or silver, are as follow.

Through the first side A, passes a fine screw B, the other end of which is fastened to the moveable side C. D is a nut applied to this screw, by the turning of which the two sides A and C are gradually brought together. E is a spring of steel that separates the two sides when the nut is unscrewed. F is a piece of brass, turning round in a socket, whence proceeds a small spring tube moving upon a rivet; though which tube there runs a steel wire, one end whereof terminates in a sharp point G, and the other with a pair of pliers H fastened to it. The point and pliers are to thrust into, or take up and hold, any insect or object; and either of them may be turned upwards, as best suits the purpose. I is a ring of brass, with a female screw within it, mounted on an upright piece of the same metal; which turns round on a rivet, that it may be set at a due distance when the least magnifiers are employed. This ring receives the screws of all the magnifiers. K is a concave speculum of silver, polished as bright as possible; in the centre of which is placed a double convex lens, with a proper aperture to look through it. On the back of this speculum a male screw L is made to fit the brass ring I, to screw into it at pleasure. There are four of these concave specula of different depths, adapted to four glasses of different magnifying powers, to be used as the objects to be examined may require. The greatest magnifiers have the least apertures. M, is a round object-plate, one side of which is white and the other black: The intention of this is to render objects the more visible, by placing them, if black, on the white side, or, if white, on the black side. A steel spring N turns down on each side to make any object fast; and issuing from the object-plate is a hollow pipe to screw it on the needle's point G. O, is a small box of brass, with a glass on each side, contrived to confine any living object, in order to examine it: this also has a pipe to screw upon the end of the needle G. P, is a turned handle of wood, to screw into the instrument when it is made use of. Q, a pair of brass pliers to take up any object, or manage it with conveniency. R, is a soft hair-brush for cleaning the glasses, &c. S, is a small ivory box for tales, to be placed, when wanted, in the small brass-box O.

When you would view any object with this microscope, screw the speculum, with the magnifier you think proper to use, into the brass ring I. Place your object, either on the needle G in the pliers H, on the object plate M, or in the hollow brass box O, as may be most convenient: then holding up your instrument by the handle P, look against the light through the magnifying lens; and by means of the nut D, together with the motion of the needle, by managing its lower end, the object may be turned about, raised, or depressed, brought nearer the glass, or removed farther from it, till you find the true focal distance, and the light be seen strongly reflected from the speculum upon the object, by which means it will be shown in a manner surprisingly distinct and clear; and for this purpose the light of the sky or of a candle will answer very well. Transparent objects may also be viewed by this microscope; only observing, that when such come under examination, it will not always be proper to throw on them the light reflected from the speculum; for the light transmitted through them, meeting the reflected light, may together produce too great a glare A little practice, however, will show how to regulate both lights in a proper manner.

4. *Ellis's Single and Aquatic Microscope.* Fig. 4. represents a very convenient and useful microscope, contrived by Mr John Ellis, author of An Essay upon Corallines, &c. To practical botanists, observers of animalcula, &c. it possesses many advantages above those just described. It is portable, simple in its construction, expeditious, and commodious in use. K, represents the box containing the whole apparatus: it is generally made of fish-skin; and on the top there is a female screw, for receiving the screw that is at the bottom of the pillar A: this is a pillar of brass, and is screwed on the top of the box. D, is a brass pin which fits into the pillar; on the top of this pin is a hollow socket to recive the arm which carries the magnifiers; the pin is to be moved up and down, in order to adjust the lenses to their focal or proper distance from the object. [N. B. In the representations of this microscope, the pin D is delineated as passing through a socket at one side of the pillar A; whereas it is usual at present to make it pass down a hole bored through the middle of the pillar.] E, the bar which carries the magnifying lens; it fits into the socket X, which is at the top of the pin or pillar D. This arm may be moved backwards and forwards in the socket X, and sideways by the pin D; so that the magnifier, which is screwed into the ring at the end E of this bar, may be easily made to traverse over any part of the object that lies on the stage or plate B. FF is a polished silver speculum, with a magnifying lens placed at the centre thereof, which is perforated for this purpose. The silver speculum screws into the arm E, as at F. G, another speculum, with its lens, which is of a different magnifying power from the former. H, the semicircle which supports the mirror I; the pin R, affixed to the semicircle H, passes thro' the hole which is towards the bottom of the pillar A. B, the stage, or the plane, on which the objects are to be placed; it fits into the small dove-tailed arm which is at the upper end of the pillar DA. C, a plane glass, with a small piece of black silk stuck on it; this glass is to lay in a groove made in the stage B. M, a hollow glass to be laid occasionally on the stage instead of the plane glass C. L, a pair of nippers. These are fixed to the stage by the pin at bottom; the steel wire of these nippers slides backwards and forwards in the socket, and this socket is moveable upwards and downwards by means of the joint, so that the position of the object may be varied at pleasure. The object may be fixed in the nippers, stuck on the point, or affixed, by a little gum-water, &c. to the ivory

Microscope

ivory cylinder N, which occasionally screws to the point of the nippers.

To *use* this microscope: Take all the parts of the apparatus out of the box; then begin by screwing the pillar A to the cover thereof; pass the pin R of the semicircle which carries the mirror thro' the hole that is near the bottom of the pillar A; push the stage into the dovetail at B, slide the pin into the pillar (see the N. B. above); then pass the bar E through the socket which is at the top of the pin D, and screw one of the magnifying lenses into the ring at F. The microscope is now ready for use: and though the enumeration of the articles may lead the reader to imagine the instrument to be of a complex nature, we can safely affirm that he will find it otherwise. The instrument has this peculiar advantage, that is difficult to put any of the pieces in a place which is appropriated to another. Let the object be now placed either on the stage or in the nippers L, and in such manner that it may be as nearly as possible over the centre of the stage: bring the speculum F over the part you mean to observe; then throw as much light on the speculum as you can, by means of the mirror I, and the double motion of which it is capable; the light received on the speculum is reflected by it on the objects. The distance of the lens F from the object is regulated by moving the pin D up and down, until a distinct view of it is obtained. The best rule is, to place the lens beyond its focal distance from the object, and then gradually to slide it down till the object appears sharp and well defined. The adjustment of the lenses to their focus, and the distribution of the light on the object, are what require the most attention: on the first the distinctness of the division depends; the pleasure arising from a clear view of the parts under observation is due to the modification of the light. No precise rule can be given for attaining accurately these points; it is from practice alone that ready habits of obtaining these necessary properties can be acquired, and with the assistance of this no difficulty will be found.

5. A very simple and convenient microscope for botanical and other purposes, though inferior in many respects to that of Mr Ellils, was contrived by the late ingenious Mr Benjamin Martin, and is represented at fig. 5. where AB represents a small arm supporting two or more magnifiers, one fixed to the upper part as at B, the other to the lower part of the arm at C; these may be used separately or combined together. The arm AB is supported by the square pillar IK, the lower end of which fits into the socket E of the foot FG; the stage DL is made to slide up and down the square pillar; H, a concave mirror, for reflecting light on the object.—To *use* this microscope, place the object on the stage reflect the light on it from the concave mirror, and regulate it to the focus, by moving the stage nearer to or farther from the lens at B. The ivory sliders pass through the stage; other objects may be fixed in the nippers MN, and then brought under the eye-glasses; or they may be laid on one of the glasses which fit the stage. The apparatus to this instrument consists of three ivory sliders; a pair of nippers; a pair of forceps; a flat glass and a concave ditto, both fitted to the stage.

The two last microscopes are frequently fitted up with a toothed rack and pinion, for the more ready adjustment of the glasses to their proper focus.

6. *Withering's portable Botanic Microscope.* Fig. 6. represents a small botanical microscope contrived by Dr Withering, and described by him in his *Botanical Arrangements*. It consists of three brass plates A,B,C, which are parallel to each other; the wires D and E are rivetted into the upper and lower plates, which are by this means united to each other; the middle plate or stage is moveable on the aforesaid wires by two little sockets which are fixed to it. The two upper plates each contain a magnifying lens, but of different powers; one of those confines and keeps in their places the fine point F, the forceps G, and the small knife H.—To *use* this instrument, unscrew the upper lens, and take out the point, the knife, and the forceps; then screw the lens on again, place the object on the stage, and then move it up or down till you have gained a distinct view of the object, as one lens is made of a shorter focus than the other; and spare lenses of a still deeper focus may be had if required. This little microscope is the most portable of any. Its principal merit is its simplicity.

7. *Botanical Lenses or Magnifiers.* The haste with which botanists, &c. have frequently occasion to view objects, renders an extempore pocket-glass indispensably necessary. The most convenient of any yet constructed, appears to be that contrived, in regard to the form of the mounting, by the late Mr Benjamin Martin; and is what he called a *Hand Megaloscope*, because it is well adapted for viewing all the larger part of small objects universally, and by only three lenses it has seven different magnifying powers.

Fig. 7. represents the case with the three frames and lenses, which are usually of 1, 1½, and 2 inches focus: they all turn over each other, and shut into the case and are turned out at pleasure.

The three lenses singly, afford three magnifying powers; and by combining two and two, we make three more; for *d* with *e* makes one, *d* with *f* another, and *e* with *f* a third; which, with the three singly, make six; and lastly, all three combined together make another; so that upon the whole, there are seven powers of magnifying with these glasses only.

When the three lenses are combined, it is better to turn them in, and look through them by the small appertures in the sides of the case. The eye in this case is excluded from extra light; the aberration of the superfluous rays through the glasses is cut off; and the eye coincides more exactly with the common axes of the lenses.

A very useful and easy kind of microscope (described by Joblot, and which has been long in use), adapted chiefly for viewing, and confining at the same time, any living insects, small animals, &c. is shown at fig. 8 Plate CCXCVIII where A represents a glass tube, about 1¾ inches diameter and 2 inches high. B, a case of brass or wood, containing a sliding tube, with two or three magnifying glasses that may be used either separately or combined. In the inside, at the bottom, is a piece of ivory, black and white on opposite sides, that is occasionally removed, and admits a point to be screwed into the centre. The cap unscrews at D, to admit the placing of the object: the proper distance of the glasses from

Microscope

from the object is regulated by pulling up or down the brass tube E at top containing the eye-glasses.

This microscope is particularly useful for exhibiting the well-known curious *curculio imperialis*, vulgarly called the *diamond beetle*, to the greatest advantage; for which, as well as for other objects, a glass bottom, and a polished reflector at the top, are often applied to condense the light upon the object. In this case, the stand and brass-bottom F, as shown in the figure, are taken away by unscrewing.

9. *Mr Lyonet's Single Anatomical Dissecting Microscope.* Fig. 9. represents a curious and extremely useful microscope, invented by that gentleman for the purpose of minute dissections, and microscopic preparations. This instrument must be truly useful to amateurs of the minutiæ of insects, &c. being the best adapted of any for the purposes of dissection. With this instrument Mr Lyonet made his very curious microscopical dissection of the *chenille de saule*, as related in his *Traité Anatomique de la chenille qui ronge le bois de saule*, 4to.

AB is the anatomical table, which is supported by a pillar NO; this is screwed on the foot CD. The table AB is prevented from turning round by means of two steady pins. In this table or board there is a hole G, which is exactly over the centre of the mirror EF, that is to reflect the light on the object; the hole G is designed to receive a flat or concave glass, on which the objects for examination are to be placed.

RXZ is an arm formed of several balls and sockets, by which means it may be moved in every possible situation; it is fixed to the board by means of the screw H. The Last arm IZ has a female screw, into which a magnifier may be screwed as at Z. By means of the screw H, a small motion may be ocasionally given to the arm IZ, for adjusting the lens with accuracy to its focal distance from the object.

Another chain of balls is sometimes used, carrying a lens to throw light upon the object; the mirror is likewise so mounted, as to be taken from its place at K, and fitted on a clamp, by which it may be fixed to any part of the table AB.

To use the Dissecting Table:—Let the operator sit with his left side near a light window; the instrument being placed on a firm table, the side DH towards the stomach, the observations should be made with the left eye. In dissecting, the two elbows are to be supported by the table on which the instrument rests, the hands resting against the board AB; and in order to give it greater stability (as a small shake, though imperceptible to the naked eye, is very visible in the microscope), the dissecting instruments are to be held one in each hand, between the thumb and two forefingers.

II. *Of* Double *Microscopes, commonly called* Compound *Microscopes.*

Double microscopes are so called, from being a combination of two or more lenses.

Th eparticular and chief advantages which the compound microscopes have over the single, are, that the objects are represented under a larger field of view, and with a greater amplification of reflected light.

1. *Culpeper's Microscope.* The compound microscope, originally contrived by Mr Culpeper, is represented at fig. 10. It consists of a large external brass body A, B, C, D, supported upon three scrolls, which are fixed to the stage EF; the stage is supported by three larger scrolls, that are screwed to the mahogany pedestal GH. There is a drawer in the pedestal which holds the apparatus. The concave mirror *I* is fitted to a socket in the centre of the pedestal. The lower part LMCD of the body forms an exterior tube, into which the upper part of the body ABLM slides, and may be moved up or down, so as to bring the magnifiers, which are screwed on at N, nearer to or farther from the object.

To *use* this microscope: Screw one of the buttons, which contains a magnifying lens, to the end N of the body; place the slider, with the objects, between the plates of the slider-holder. Then, to attain distinct vision, and a pleasing view of the object, adjust the body to the focus of the lens you are using, by moving the upper part gently up and down, and regulate the light by the concave mirror.

For opaque objects, two additional pieces must be used. The first is a cylindrical tube of brass (represented at L, fig. 11.), which fits on the cylindrical part at N of the body. The second piece is the concave speculum *h*; this is to be screwed to the lower end of the aforesaid tube: the upper edge of this tube should be made to coincide with the line which has the same number affixed to it as to the magnifier you are using; *ex. gr.* if you are making use of the magnifier marked 5, slide the tube to the circular line on the tube N that is marked also with N° 5. The slider-holder should be removed when you are going to view opaque objects, and a plane glass should be placed on the stage in its stead to receive the object; or it may be placed in the nippers, the pin of which fits into the hole in the stage.

The apparatus belonging to this microscope consists of the following particulars; *viz.* Five magnifiers each fitted in a brass button; one of these is seen at N, fig. 10. Six ivory sliders, five of them with objects. A brass tube, to hold the concave speculum. The concave speculum in a brass box. A fish pan. A set of glass tubes. A flat glass fitted to the stage. A concave glass fitted to the stage. A pair of forceps. A steel wire, with a pair of nippers at one end, and a point at the other. A small ivory cylinder, to fit on the pointed end of the aforesaid nippers. A convex lens, moveable in a brass semicircle; this is affixed to a long brass pin, which fits into a hole on the stage.

The construction of the foregoing microscope is very simple, and it is easy in use; but the advantages of the stage and mirror are too much confined for an extensive application and management of all kinds of objects. Its greatest recommendation is its cheapness; and to those who are desirous of having a compound microscope at a low price, it may be acceptable.

2. *Cuff's Microscope.* The improved microscope next in order is that of Mr Cuff. Besides remedying the disadvantages abovementioned, it contains the addition of an adjusting screw, which is a considerable improvement, and highly necessary to the examination of objects under the best defined appearance from the glasses. It is represented at fig. 11. with the apparatus that usually accompanies it. A, B, C, shows the body of this microscope; which contains an eye-glass at A, a broad lens at B, and a mag-

Microscope a magnifier which is screwed on at C. The body is supported by the arm D E, from which it may be removed at pleasure. The arm D E is fixed on the sliding bar F, and may be raised or depressed to any height within its limits. The main pillar *a b* is fixed in the box *b e;* and by means of the brass foot *d* is screwed to the mahogany pedestal X Y, in which is a drawer containing all the apparatus. O, is a milled-headed screw, to tighten the bar F when the adjusting screw *c g* is used. *p q* Is the stage or plate which carries the objects; it has a hole at the centre *n*. G a concave mirror, that may be turned in any direction, to reflect the light of a candle, or the sky, upon the object.

To *use* this microscope: Screw the magnifier you intend to use to the end C of the body, place the slider-holder P in the hole *n*, and the slider with the object between the plates of the slider holder; set the upper edge of the bar D E to coincide with the divisions which correspond to the magnifier you have in use, and pinch it by the milled nut; now reflect a proper quantity of light upon the object, by means of the concave mirror G and regulate the body exactly to the eye and the focus of the glasses by the adjusting screw *c g*.

To view *opaque* objects, take away the slider-holder P, and place the object on a flat glass under the centre of the body, or on one end of the jointed nippers *o p*. Then screw the silver concave speculum *h* to the end of the cylinder L, and slide this cylinder on the lower part of the body, so that the upper edge thereof may coincide with the line which has the same mark with the magnifier that is then used; reflect the light from the concave mirror G to the silver speculum, from which it will again be reflected on the object. The glasses are to be adjusted to their focal distance as before directed.

The *apparatus* consists of a convex lens H, to collect the rays of light from the sun or a candle, and condense them on the object. L a cylindrical tube, open at each side, with a concave speculum screwed to the lower end *h*. P the slider-holder: this consists of a cylindrical tube, in which an inner tube is forced upwards by a spiral spring; it is used to receive an ivory slider K, which is to be slid between the plates *h* and *i*. The cylinder P fits the hole *n* in the stage; and the hollow part at *k* is designed to receive a glass tube. R is a brass cone, to be put under the bottom of the cylinder P, to intercept occasionally some of the rays of light. S a box containing a concave and a flat glass, between which a small living insect may be confined: it is to be placed over the hole *n*. T a flat glass, to lay any occasional object upon; there is also a concave one for fluids. O is a long steel wire, with a small pair of pliers at one end, and a point at the other, designed to stick or hold objects; it slips backwards and forwards in the short tube *o;* the pin *p* fits into the hole of the stage. W a little round ivory box, to hold a supply of talc and rings for the sliders. V a small ivory cylinder, that fits on the pointed end of the steel wire: it is designed for opaque objects. Light-coloured ones are to be stuck upon the dark side, and *vice versa*. M a fish-pan, whereon to fasten a small fish, to view the circulation of the blood; the tail is to be spread across the oblong hole *k* at the small end, and tied fast, by means of a ribband fixed thereto; the knob *l* is to be shoved through the slit made in the stage, that the tail may be brought under the magnifier. Microscope

3. This microscope has received several material improvements from Mr Martin, Mr Adams, &c. By an alteration, or rather an enlargement, of the body of the tube which contains the eye-glasses, and also of the eye-glasses, themselves, the field of view is made much larger, the mirror below for reflecting light is made to move upon the same bar with the stage; by which means the distance of it from the stage may be very easily and suitably varied. A condensing glass is applied upon the stage in the slider-holder, in order to modify and increase the light that is reflected by the mirrors below from the light of a candle or lamp. It is furnished also with two mirrors in one frame, one concave and and the other plane, of glass silvered; and by simply unscrewing the body, the instrument, when desired, may be converted into a single microscope. Fig. 12. is a representation of the instrument thus improved; and the following is the description of it, as given by Mr Adams in his Essays.

A B represents the body of the microscope, containing a double eye-glass and a body glass: it is here shown as screwed to the arm C D, from whence it may be occasionally removed, either for the convenience of packing, or when the instrument is to be used as a single microscope.

The eye glasses and the body glasses are contained in a tube which fits into the exterior tube A B; by pulling out a little this tube when the microscops is in use, the magnifying power of each lens is increased.

The body A B of the microscope is supported by the arm C D; this arm is fixed to the main pillar C F, which is screwed firmly to the mahogany pedestal G H; there is a drawer to this pedestal, which holds the apparatus.

N I S, The plate or stage which carries the slider-holder K L: this stage is moved up or down the pillar CF, by turning the milled nut M; this nut is fixed to a pinion, that works in a toothed rack cut on one side of the pillar. By means of this pinion, the stage may be gradually raised or depressed, and the object adjusted to the focus of the different lenses.

K L is a slider-holder, which fits into a hole that is in the middle of the stage N I S; it is used to confine and guide either the motion of the sliders which contain the objects, or the glass tubes that are designed to confine small fishes for viewing the circulation of the blood. The sliders are to be passed between the two upper plates, the tubes through the bent plates.

L is a brass tube, to the upper part of which is fixed the condensing lens before spoken of; it fits into the under part of the slider-holder K L, and may be set at different distances from the object, according to its distance from the mirror or the candle.

O is the frame which holds the two reflecting mirrors, one of which is plane, the other concave. These mirrors may be moved in various directions, in order to reflect the light properly, by means of the pivots on which they move, in the semicircle Q S R, and the motion of the semicircle itself on the pin S: the concave mirror generally answers best in the day-time; the plane mirror combines better with the condensing lens,

Fig. 8

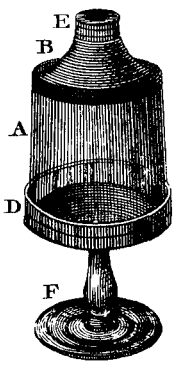


Fig. 9.

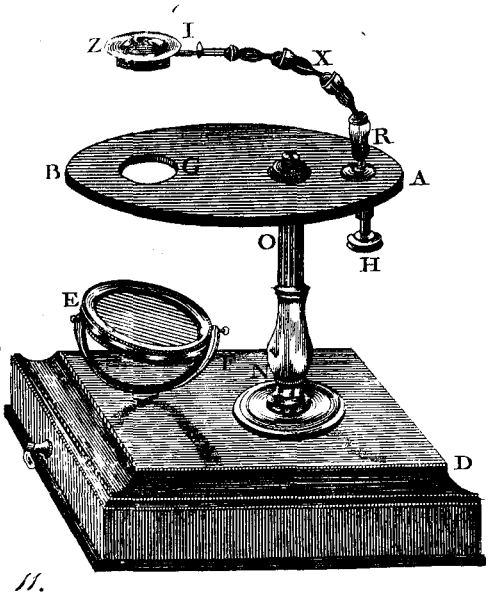


Fig. 10.

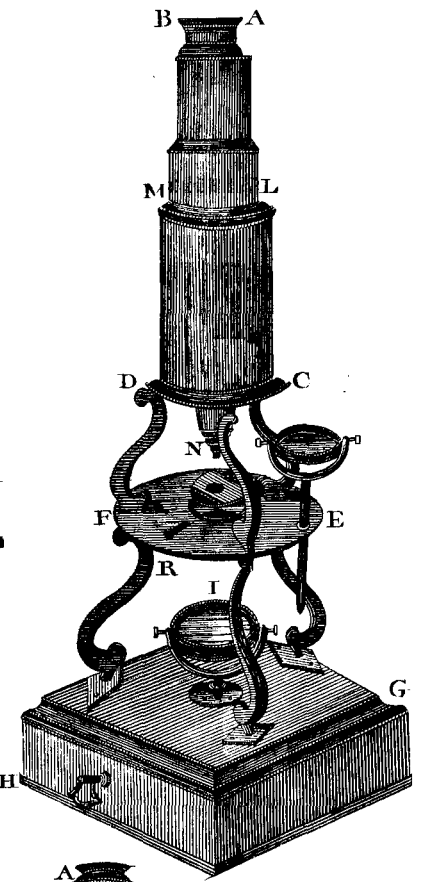


Fig. 11.

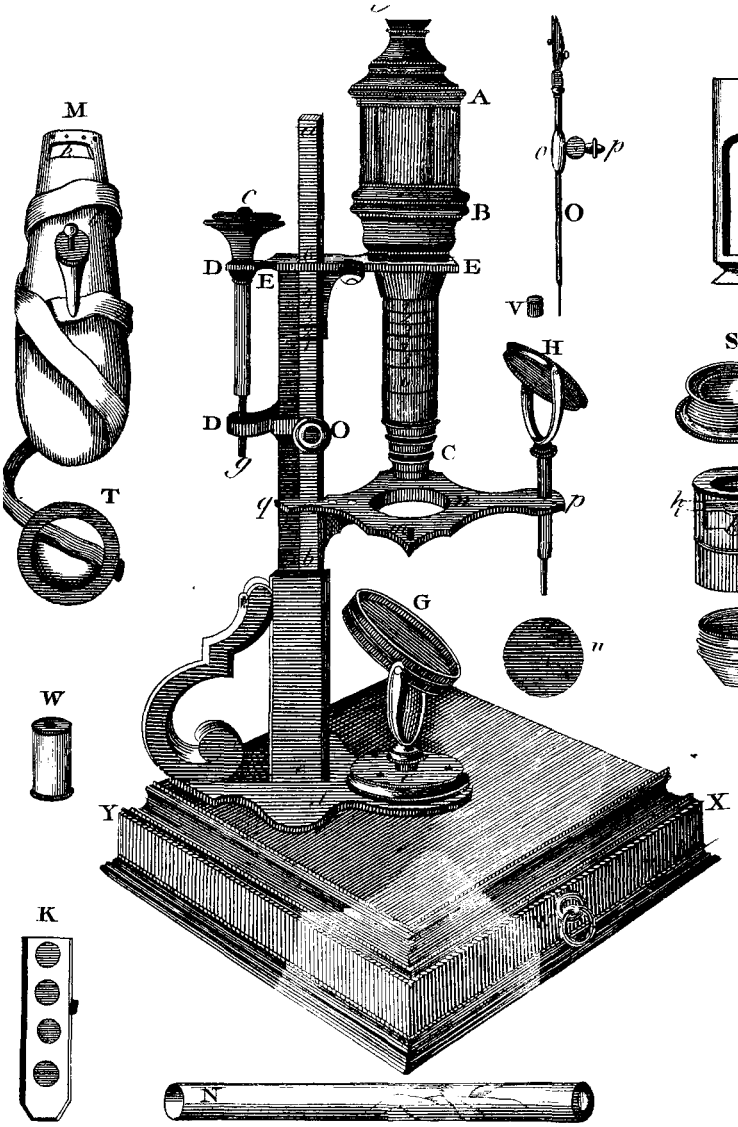
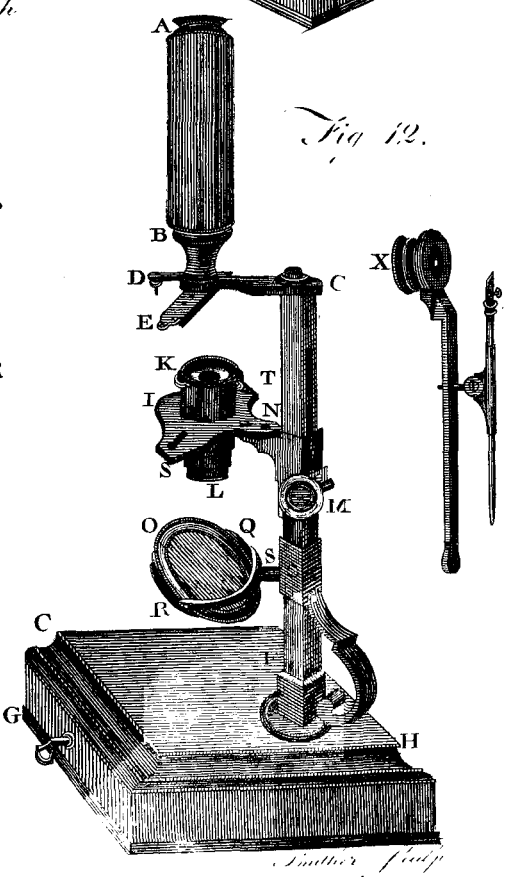


Fig 12.



Microscope lens, and a lamp or candle. At D there is a socket for receiving the pin of the arm Q (fig. 31.), to which the concave speculum, for reflecting light on opaque objects, is fixed. At S is a hole and slit for receiving either the nippers L (fig. 31. Pl. ccci.) or the fish-pan I; when these are used, the slider-holder must be removed. T, a hole to receive the pin of the convex lens M, fig. 31.

To *use* this microscope: Take it out of the box. Screw the body into the round end of the upper part of the arm C D. Place the brass sliders, which contain the magnifiers, into the dove-tailed slit which is on the under side of the aforesaid arm, as seen at E, and slide it forwards until the magnifier you mean to use is under the centre of the body: opposite to each magnifier in this slit there is a notch, and in the dove-tailed part of the arm C D there is a spring, which falls into the abovementioned notch, and thus makes each magnifier coincide with the centre of the body. Pass the ivory slider you intend to use between the upper plates of the slider-holder KL, and then reflect as strong a light as you can on the object by means of one of the mirrors; after this, adjust the object to the focus of the magnifier and your eye, by turning the milled screw M, the motion of which raises and depresses the stage N I S. The degree of light necessary for each object, and the accuracy required in the adjustment of the lenses to their proper focal distance from the object will be easily attained by a little practice.

When *opaque* objects are to be examined, remove the slider-holder, and place the object on a flat glass, or fix it to the nippers L, the pin of these fit into the hole on the stage; screw the concave speculum R into the arm Q (fig. 31.), and then pass the pin of this arm through the socket D, fig. 12, the light is now to be reflected from the concave mirror to the silver speculum, and from this down on the object. No exact rule can be given for reflecting the light on the object; we must therefore refer the reader to the mother of all aptness, practice. The speculum must be moved lower or higher, to suit the focus of the different magnifiers and the nature of the object.

The foregoing directions apply equally to the using of this instrument as a *single microscope;* with this difference only, that the body A B is then removed, and the eye is applied to the upper surface of the arm CD, exactly over the magnifiers.

This microscope is sometimes made with the following *alterations*, which are supposed to make it still more convenient and useful. The arm CD that carries the body and magnifiers is made both to turn on a pin, and to slide backwards and forwards in a socket at C; so that, instead of moving the objects below on the stage, and disturbing them, the magnifiers are more conveniently brought over any part of the objects as desired. The condensing glass is made larger, and slides upon the square bar CF quite distinct from the stage, like the mirrors below; and it is thereby made useful for any other objects that may be applied on glasses fitted to the stage, as well as those put into the slider-holder K. It is thereby not confined to this stage alone, as in the preceding. When the body A B is taken away, the arm C D may be slipt away from its bar, with the magnifiers, and the forceps, wire, and joint, applied to it; and it thereby serves the purpose of a small hand single or opaque microscope, for any object occasionally applied to this wire. The magnifiers in the slider E are mounted in a wheel case, which perhaps prevents its being in the way so much as the long slider E before described.—This contrivance is represented at X, fig. 12.

4. *Martin's New Universal Compound Microscope.*—This instrument was originally constructed by the late Mr B. Martin, and intended to comprise all the uses and advantages of the single, compound, opaque, and aquatic microscopes. The following is a description of it as now made, with a few alterations, chiefly suggested (we are told) by Mr Jones of Holborn.

Fig, 13. is a representation of the instrument placed up for use. A, B, C, D, is the body of the microscope: which consists of four parts, viz. AB the eye-piece, or that containing the eye-glasses, and is screwed into C, which is a moveable or sliding tube on the top; this inner tube contains the body-glass screwed into its lower part. D is the exterior tube or case, in which the other slides up and down in an easy and steady manner. This motion of the tube C is useful to increase or decrease the magnifying power of the body-glass when thought necessay, as before mentioned. E is a pipe or snout screwed on to the body of the microscope D, and at its lower part, over the several magnifying lenses hereafter described. FGHI is the square stem of the microscope, upon which the stage R moves in an horizontal position, upwards or downward, by means of the fine rackwork of teeth and pinion. KL is a strong solid joint and pillar, by which the position of the instrument is readily altered from a vertical one to an oblique or to a perfectly horizontal one, as may be required: it is thus well adapted to the ease of the observer either sitting or standing; and as it is very often convenient to view objects by direct unreflected light, when the square stem FI is placed in an horizontal position for this purpose, the mirror T is then to be taken off in order to prevent the obstruction of the rays. M is a circular piece of brass, serving as a base to the pillar. NOP, the tripod or foot by which the whole body of the microscope is steadily supported; it folds up when packed into the case. W is a brass frame, that contains the condensing lens, and acts in conjunction with the large concave and plane mirrors below at T; the reflected rays from which, either of the common light or of that of a candle or lamp, it agreeably modifies, and makes steady in the field of view. Plate CCXCIX.

The particulars of the apparatus to this microscope are as follow: Q is a circular brass box, containing six magnifiers or object lenses, numbered 1, 2, 3, 4, 5, 6; the digits of which appear severally through a small round hole in the upper plate of it. To the upper side is fixed a small circle of brass, by which it is connected with, and screwed into, the round end of the arm *a b c d;* which is a long piece of brass, and moves through either by teeth or pinion, or not, as may be desired, in *e f;* which is a socket on the upper part of the pillar, and admits, with a motion both easy and steady, the brass arm. R is a fixed stage, upon which the objects to be viewed are to be placed: it is firmly fastened to the square-pillar, which is moved by the rackwork. In the middle is a large circular hole, for

Microscope receiving concave glasses, with fluids, &c. it has also a sliding spring-frame to fasten down slips of glass or other things: at *a b c* are three small sockets or holes, intended to receive several parts of the apparatus. S is the refractor, or illuminating lens, for converging the sun's rays upon opaque objects laid upon the stage R. To this purpose it moves on a semicircle upon a long shank *g*, in a spring socket *h*, in the arm *i*; this arm moving every way by a stout pin *k* in the socket *a* of the stage. In this manner it is easily adjusted to any position of the sun, candle &c.— T, the reflecting-glass frame, containing a concave and plane speculum, which is moved upon the square pillar by the hand. The use of it is to illuminate all transparent objects that are applied to the stage above.

Fig. 14. n°1. is an auxiliary moveable stage; which by means of a pin *k* is placed in the hole *a* of the stage R, and can be moved in an horizontal direction over the whole field of the stage. In this stage, there are three circular holes with shouldered bottoms; a large one in the middle, and on each side a small one, for the reception of the three following necessary articles: n° 2. a watch-glass to be placed in the large hole, to hold fluids containing animalcules, &c.; a circular piece of ivory, n° 3. one side of which is black, the other white, to support opaque objects of different contrasted colours; and circular plane and concave glasses, n° 4. for extemporaneous transparent objects.— The same use is made of the other small hole as of the large one, only in a lesser degree, to receive small concave glasses, plates. &c.

N° 5. is the silvered speculum, called a *Liberkhun*, which makes the single opaque microscope, by being screwed to the slider *a b c d* (fig. 13.) in room of the box of lenses Q, and the body AE above it. The chief use of this is to view very small objects strongly illuminated near the compounded focus of the mirror T (fig. 13.) N° 6. is the forceps or pliers, for holding such kind of objects, and by which they can be applied very readily to the focus of the lens, in the liberkhun. They have a motion all ways by means of the spring socket *a*, the joint *b*, and the shank *c*: they are placed in the socket *c* of the fixed stage R (fig. 13.) N° 7. is a small piece of ivory, to be placed upon the pointed end of the pliers: it is black upon one side, and white upon the other to receive opaque objects.

N° 8. is a liberkhun of a larger size than that first mentioned, with a hole in its centre; this is screwed into n° 9. the hole *a* of a brass ring, fastened to a long wire *b*; which moves up and down in the spring socket *b* of the stage R, in which it also moves sideways; and thus, with body AE above, forms an *aquatic compound microscope* for showing all sorts of objects in water and other fluids placed under it in the watch-glass n° 2. on the stage.

N° 11. is a cone with a proper aperture *a* to exclude superfluous light, that would disturb a critical observation of a curious object; it is placed on the under side of the fixed stage R.

N° 12. is what is usually called a bug-box, consisting of a concave glass with a plane one screwed over it by means of which a bug, louse, flea, &c. may be secured and viewed alive. It is to be placed on either of the stages R (fig. 13.), or n° 1 (fig. 14.) Microscope

N° 13. is the fish pin. In the long concave body *ab*, a fish may be so confined by the ribband *c*, that the transparent tail may be in part over the slit or hole at *a*. In this state, it is placed on the stage R, with the pin *d* in the hole *c* of the stage, and moves freely and horizontally for viewing the circulation of the blood, &c.

N° 14. is the slider holder-that is placed on the stage R: it receives the sliders and tubes when filled with transparent objects, to be viewed either by the compound or single microscope.

N° 15. represents the ivory slider, to hold the objects between the talcs as usual.

N° 16. is a useful auxiliary slider framed in brass. In this slider small concave glasses are cemented; and a slip of plane glass slides over them; by which any small living object, as mites, &c. may be confined without injury, and deliberately viewed.

N° 17. represents a set of glass tubes, three in number, one within another; they are useful for small tadpoles, water-newts, eels, &c. when the circulation of the blood is to be viewed. There is a small hole at one end of each tube, that serves to admit the air; for when they are filled with water, the other end is stopped with a cork.

N° 18. is a small ivory box, containing spare talcs and wires, to supply the sliders with occasionally.

N° 19. a brass cell or button, containing a very small lens, properly set between two small plates of brass, that it may be brought very near to the object when viewed therewith as a single microscope. This magnifier is screwed into the same hole as the wheel of six magnifiers Q are (fig. 13).

N° 20. is a lens, adapted to view and examine objects, by magnifying them sufficiently, so as to be able to apply them to the microscope for inspection: on this account it is called the *explorator*.

The preceding are the chief articles of the apparatus, which on account of their being somewhat different from what is applied to other microscopes, we have been thus particular in describing. In using the microscope, and while viewing objects by either the single or compound instrument, the focal distances of the magnifiers are made perfectly exact by turning of the pinion at the nut *w*, in one way or the other, very gently in the teeth of the rack-work at X (fig. 13).

It is necessary that the centres of the object lenses or magnifiers, the stage, and the mirrors at bottom, should all be in a right line in the axis of the microscope, when opaque objects are to be viewed, that are placed upon the ivory piece n° 7, or the forceps n° 6. and all other such sort of objects which are placed in the centre of the stage R, or slider-holder n° 14: But when aquatic or living objects, which require a great space to move in, are to be viewed, then the horizontal motion at *e f* (fig. 13.) is made use of, and the view may be extended laterally over the whole of the diameter of the object or field of view; and by putting the arm *a b c d* forward or backward in its socket *e f*, the view is extended in the contrary direction equally well; and in this manner the whole

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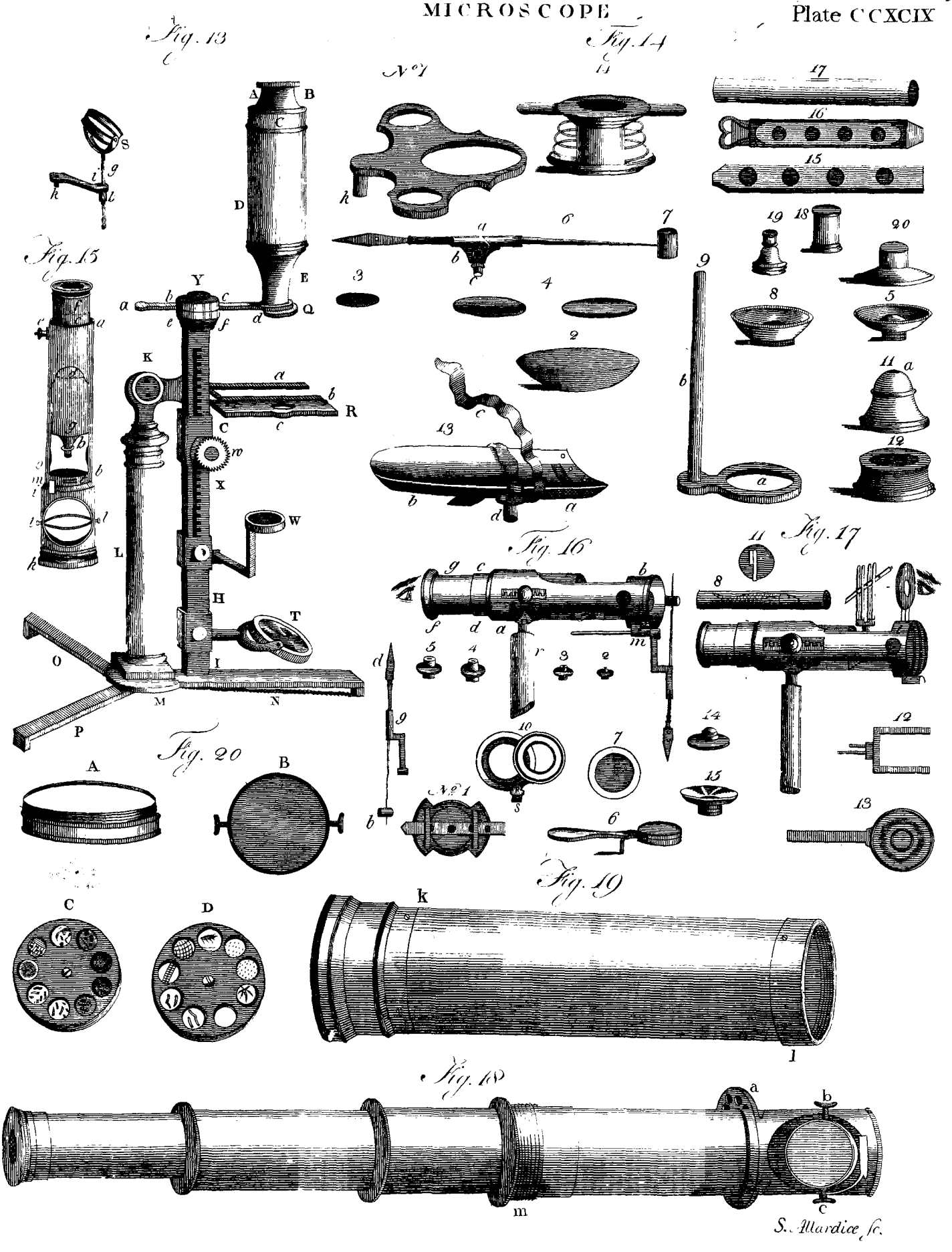

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Microscope

of the objects may be viewed without the least disturbance.

As the brass arm *abcd* may be brought to the height of three or four inches above the stage R; so, by means of the rack-work motion of the stage, a lens of a greater focal distance than the greatest in the wheel Q may be occasionally applied in place of the wheel, and thereby the larger kind of objects be viewed; the instrument becoming, in this case, what is called a *megalascope*.

In viewing moving living objects, or even fixed ones, when nice motions are requisite, a rack-work and pinion is often applied to the arm *abcd*: the arm is cut out with teeth; and the pinion, as shown at Y, is applied to work it. This acts but in one direction; and in order to produce an equally necessary motion perpendicular to this, rack-work and pinion is applied tangent-wise to the stage, which is then jointed.

What has been related above respects the construction of those denominated *parlour* microscopes, in contradistinction to those which are portable: their dimensions, however, have been considerably reduced by opticians, in order to render them fit for the pocket; and as they are for the most part constructed on nearly the same principles as those which have been already described, what has been said will sufficiently instruct our readers in using any pocket microscope whatever. Only it may be observed, that in those reduced instruments, both the field of view and the magnifying power are proportionably diminished.

We shall conclude the account of this sort of microscope with descriptions of a very portable pocket apparatus of microscopic instruments, and of a new microscopic pocket-telescope, both invented by the late Mr B. Martin, and since made by most instrument makers in London.

The former is represented at fig. 15. It consists of two parts, viz. the body *ab*, and the pedestal *ik*, which is joined by a screw at the part between *b* and *i*. It consists of three cylindric tubes, viz. (1.) the exterior tube, or case *ab*; (2.) a middle tube *cb*; and (3.) the interior tube *fg*.—The middle tube *cd* is the adjuster; and is connected with the outer tube by the rack-work of teeth and pinion, as shown at *e*: by which means it is moved up and down at pleasure through the smallest space, and carries with it the internal tube *fg*. The interior tube *fg* receives on its lower part at *b* the several capsules or boxes, 2, 3, 4, 5, (fig. 16.) which contain the object lenses or magnifiers.

The method of *using* this compound microscope in the perpendicular position, is as follows. The stage n° 1. is put within the exterior tube at *b*. Under the springs are applied the four ivory sliders, which contain a variety of transparent objects; then move the interior tube *fg* up and down with the hand, till you discern the object in the slider, and there let it rest. After this, turn the pinion at *e* very tenderly one way or the other, till you obtain a perfect view of the transparent objects properly illuminated, from a mirror contained in the pedestal or stand *ik*, suspended upon, and moveable about, the points of two screws *(ll)*. N° 6. (fig. 16.) represents a moveable stage, which is placed in the spring socket *m*. It contains a concave glass for the reception of animalcules in fluids; and has the advantage of bringing any part into view by moving the handle at *n*. If living and moving objects are required to be shown, they must be confined in the concave, by putting a glass cover, n°7. upon the stage; and then a small spider, a louse flea, bug, &c. may be seen, and the motion or circulation of the blood, &c. observed with surprising distinctness.

To view the circulation of the blood in the most eminent degree, it must be done by placing small frogs tadpoles, water-newts, fishes, &c. in a tube as represented n° 8. (fig. 17.); which tube is placed in the holes *o* in the opposite sides of the case *ab*, fig. 15. in the lower part.—N° 9. (fig. 16.) is a pair of pincers or pliers *d*, for holding any object; the other end of the steel wire is pointed to receive a piece of ivory *b*, with one end black and the other white, on which you stick objects of different hue: this also, when used, is placed in the spring socket *m*.

To use this instrument as a compound opaque, you screw off the body part *ab*, and screw to it the handle *r* (fig. 16.); by this means you may hold the microscope in a horizontal position, as shown in the figure. The silver dish or speculum (which is contained in the bottom or base *k*, fig. 15), is then screwed on at *b*. N° 9. is placed in the spring-socket *m*, and adjusted backward and forward in *m*, till the reflected light from the speculum falls in a proper manner on the opaque object. Either of the 4 magnifiers, 2, 3, 4, 5, may be used, and brought to a proper focus, as before described by the tooth and pinion *e* fig. 15.) If you take off the opaque apparatus, and apply the stage n° 1. (fig. 16.) with an ivory slider, and at the end *b* screw in either of the two lenses n° 10. (which are distinguished by the name of illuminators), the microscope being held up to the light (and properly adjusted), the whole field of view will be strongly illuminated, and present a most pleasing appearance of any transparent object. These two convex lenses are of different focuses, and are to be used singly or together; n° 2. being the greatest magnifier, will require the object to be strongly illuminated, and of course both the lenses must be used together. By candle-light, this method of viewing transparent objects will prove very entertaining; by screwing the handle *r* into the part *s* of n° 10. it becomes a delightful hand megalascope for viewing flowers, fossils, shells, &c.; and each lens, as before mentioned, having a different focus, produces two magnifying powers used singly, and when combined a third.

The manner of using this instrument as a single microscope (like Wilson's) is represented in fig. 17. where the button or magnifier at each is to be screwed off, and the circular piece n° 11. is screwed in its place. This piece has a spring socket made to receive the slider holder n° 12. N° 13. is a circular piece of brass, with a long shank and spring, and is introduced through the outside tube *ab* at *t*. N° 2, 3, 4, 5, are screwed occasionally in the centre of this piece, and used as single lenses with ivory sliders, &c. N° 14. contains a lens of a great magnifying power. for viewing very minute objects: to render this instrument the most complete single opaque microscope, you have only to screw into n° 13. the silver speculum

n° 15

Microscope n° 15, which has a small lens set in its centre. The slider-holder n° 12 is taken out of n° 11, and the pincers or nippers *d b*, being detached from the other part of n° 9. are passed through the long spring socket n° 11. and ready to receive any opaque body in the pincers or on the black or white piece of ivory. To the large screw of n° 13. are applied the two lenses n° 10. which make it the completest megalascope that can be desired.

The handle *r* contains the four ivory sliders with objects.

The shagreen case which contains this universal microscope and its apparatus, is six inches long, three inches wide, two inches deep, and weighs together 16 ounces. "Thus (says Mr Martin) so small, so light, so portable, and yet so universally complete, is this pocket microscope apparatus, that you find nothing material in the large three-pillared microscope, the opaque microscope, Wilson's single microscope, and the aquatic microscope, all together, which you have not in this; beside some very considerable advantages in regard to the field of view, &c. which they have not (A)."

This inventive artist having contrived a construction of the compound microscope so small as to admit of being packed in a common walking cane, thought next of introducing the same instrument into the inside of what he called his *Pocket Three-brass drawer Achromatic Telescope*. The same eye-glasses that serve the purpose of a telescope, answer as the compound magnifier for viewing transparent opaque objects in a microscope.

Fig. 18. 19. 20. represent the telescope separated by unscrewing it at *m*, in order that the whole of the necessary parts in use may be exhibited. Fig 19. represents the exterior tube, which is of mahogany, and its rims of brass. It is detached from the rest of the telescope, as not making any part of the microscope. The brass cover *k l*, that shuts up the object-glass of the telescope, is also the box which contains the two-wheel object-frames, and a small plain reflecting mirror.

In fig. 20. A is the cover taken off, by unscrewing the top part: The mirror B is taken out; and also, by unscrewing the bottom part, the two circular wheels with the objects shown in C and D.

Fig. 18. is a representation of the three internal brass sliding tubes of the telescope, which form the microscopic part. The tubes are to be drawn out as shown in this figure; then, at the lower end of the large tube in the inside, is to be pulled out a short tube *b c*, that serves as a kind of stage to hold the wheels with objects, and support the reflecting mirror. This tube is to be partly drawn out, and turned so that the circular hole that is pierced in it may coincide with a similar hole that is cut in the exterior tube. This tube is represented as drawn out in the figure; and the mirror B placed therein, and the wheel with transparent objects. C (fig. 20.) represents the wheel with transparent objects, and D the wheel with opaque objects. They are both made of ivory; and turn round upon a centre brass pin slit upon the top, which fits upon the edge of the tube; which tube is then to be pushed up into the telescope tube, so that its lower end may rest upon the upper edge of the wheel according to its view at *a* fig. 18.

In viewing the objects, the second brass tube of the telescope must be pushed down, till its milled edge at top falls upon that of the exterior tube; taking care that the circular hole is duly placed to the exterior one. These circular holes are not seen in fig. 18. being supposed in the opposite side, where the wheel is fixed. The adjustment for the focus is now only necessary; which is obtained by pushing downwards or upwards the proper tube, till the object appears quite distinct. In viewing transparent objects, the instrument may be used in two positions; one vertical, when the light is to be reflected upon the object by the mirror; the other, by looking up directly against the light of a candle, common light, &c.; in which case the mirror must be taken away. In viewing opaque objects, the mirror is not used: but as much common light as possible must be admitted through the circular holes in the sides of the tubes.

There is a spare hole in the transparent wheel, and also one in the opaque, to receive any occasional object that is to be viewed. Any sort of object whatsoever, may be viewed, by only pushing up the microscope tube into its exterior, and bringing the first eye-tube to its focal distance from the object.

The brass tubes are so contrived, that they stop when drawn out to the full length: so that by applying one hand to the outside tube, and the other to the end of the smallest tube, the telescope at one pull may be drawn out; then any of the tubes (that next to the eye is best) may be pushed in gradually, till the most distinct view of the object be obtained.

The tubes all slide through short brass spring tubes, any of which may be unscrewed from the ends of the sliding tubes by means of the milled edges which project above the tubes, taken from each other, and the springs set clear if required.

III. *Of Solar Microscopes.*

This instrument, in its principle, is composed of a tube, a looking-glass or mirror, a convex lens, and Wilson's single microscope before described. The sun's rays being reflected through the tube by means of the mirror upon the object, the image or picture of the object is thrown distinctly and beautifully upon a screen of white paper or a white linen sheet, placed at

Plate CCC.

(A) Notwithstanding the properties that have been ascribed to the above instrument, and the praises bestowed upon it by some, which induced us to admit so minute a description; we must apprise our readers, that it has been omitted in Mr Adam's enumeration: and upon inquiry we learn, that it has fallen into neglect among the most judicious opticians, being found too imperfect to serve the purposes of science, and too complicated for the use of persons who seek only entertainment.

Microſcope at a proper diſtance to receive the ſame; and may be magnified to a ſize not to be conceived by thoſe who have not ſeen it: for the farther the ſcreen is removed, the larger will the object appear; inſomuch, that a louſe may thus be magnified to the length of five or ſix feet, or even a great deal more; though it is more diſtinct when not enlarged to above half that ſize.

The different forms in which the Solar Microſcope is conſtructed, are as follow.

I. The old conſtruction is repreſented in fig. 21. A is a ſquare wooden frame, through which paſs two long ſcrews aſſiſted by a couple of nuts 1, 1. By theſe it is faſtened firmly to a window ſhutter, wherein a hole is made for its reception; the two nuts being let into the ſhutter, and made faſt thereto. A circular hole is made in the middle of this frame to receive the piece of wood B, of a circular figure; whoſe edge, that projects a little beyond the frame, compoſes a ſhallow groove 2, wherein runs a catgut 3; which by twiſting round, and then croſſing over a braſs pully 4, (the handle whereof 5, paſſes through the frame), affords an eaſy motion for turning round the circular piece of wood B, with all the parts affixed to it. C is a braſs tube, which, ſcrewing into the middle of the circular piece of wood, becomes a caſe for the uncovered braſs tube D to be drawn backwards or forwards in. E is a ſmaller tube, of about one inch in length, cemented to the end of the larger tube D. F is another braſs tube, made to ſlide over the above deſcribed tube E; and to the end of this the microſcope muſt be ſcrewed, when we come to uſe it. 5. A convex lens, whoſe focus is about 12 inches, deſigned to collect the ſun's rays, and throw them more ſtrongly upon the object. G is a looking-glaſs of an oblong figure, ſet in a wooden frame, faſtened by hinges in the circular piece of wood B, and turning about therewith by means of the abovementioned cat-gut. H is a jointed wire partly braſs and partly iron; the braſs part whereof 6, which is flat, being faſtened to the mirror, and the iron part 7, which is round, paſſing through the wooden frame, enable the obſerver, by putting it backwards or forwards to elevate or depreſs the mirror according to the ſun's altitude. There is a braſs ring at the end of the jointed wire 8, whereby to meaſure it with the greater eaſe. The extremities of the cat-gut are faſtened to a braſs pin, by turning of which it may be braced up, if at any time it becomes too ſlack.

When this microſcope is employed, the room muſt be rendered as dark as poſſible; for on the darkneſs of the room, and the brightneſs of the ſunſhine, depend the ſharpneſs and perfection of your image. Then putting the looking-glaſs G through the hole in your window-ſhutter, faſten the ſquare frame A to the ſhutter by its two ſcrews and nuts 1, 1. This done, adjuſt your looking glaſs to the elevation and ſituation of the ſun, by means of the jointed wire H, together with the cat gut and pulley, 3, 4. For the firſt of theſe raiſing or lowering the glaſs, and the other inclining it to either ſide, there reſults a twofold motion, which may eaſily be ſo managed as to bring the glaſs to a right poſition, that is, to make it reflect the ſun's rays, directly through the lens 5, upon the paper ſcreen, and form thereon a ſpot of light exactly round. But though the obtaining a perfect circular ſpot of light upon the ſcreen before you apply the microſcope, is a certain proof that your mirror is adjuſted right, that proof muſt not always be expected: for the ſun is ſo low in winter, that if it ſhine in a direct line againſt the window, it cannot then afford a ſpot of light exactly round; but if it be on either ſide, a round ſpot may be obtained, even in December. As ſoon as this appears, ſcrew the tube C into the braſs collar provided for it in the middle of your wood-work, taking care not to alter your looking-glaſs: then ſcrewing the magnifier you chooſe to employ to the end of your microſcope in the uſual manner, take away the lens at the other end thereof, and place a ſlider, containing the objects to be examined, between the thin braſs plates, as in the other ways of uſing the microſcope.

Things being thus prepared, ſcrew the body of the microſcope over the ſmall end E of the braſs, tube F; which ſlip over the ſmall end E of the tube D, and pull out the ſaid tube D leſs or more as your object is capable of enduring the ſun's heat. Dead objects may be brought within about an inch of the focus of the convex lens 5; but the diſtance muſt be ſhortened for living creatures, or they will ſoon be killed.

If the light fall not exactly right, you may eaſily, by a gentle motion of the jointed wire and pulley, direct it through the axis of the microſcopic lens. The ſhort tube F, to which the microſcope is ſcrewed, renders it eaſy, by ſliding it backwards or forwards on the other tube E, to bring the objects to their focal diſtance; which will be known by the ſharpneſs and clearneſs of their appearance: they may alſo be turned round by the ſame means without being in the leaſt diſordered.

The magnifiers moſt uſeful in the ſolar microſcope are in general, the fourth fifth or ſixth. The ſcreen on which the repreſentations of the objects are thrown, is uſually compoſed of a ſheet of the largeſt elephant paper, ſtrained on a frame which ſlides up or down, or turns about at pleaſure on a round wooden pillar, after the manner of ſome fire-ſcreens. Larger ſcreens may alſo be made of ſeveral ſheets of the ſame paper paſted together on cloth, and let down from the ceiling with a roller like a large map.

"This microſcope (ſays Mr Baker) is the moſt entertaining of any; and perhaps the moſt capable of making diſcoveries in objects that are not too opaque: as it ſhows them much larger than can be done any other way. There are alſo ſeveral conveniences attending it, which no other microſcope can have: for the weakeſt eyes make uſe of it without the leaſt ſtraining or fatigue: numbers of people together may view any object at the ſame time; and by pointing to the particular parts thereof, and diſcourſing on what lies before them, may be able better to underſtand one another, and more likely to find out the truth, than in other microſcopes, where they muſt peep one after another, and perhaps ſee the object neither in the ſame light nor in the ſame poſition. Thoſe alſo, who have no ſkill in drawing, may, by this contrivance, eaſily ſketch out the exact figure of any object they have a mind to preſerve a picture of; ſince they need only faſten a paper on the ſcreen, and trace it

it out thereon either with a pen or pencil, as it appears before them. It is worth the while of those who are desirous of taking many draughts in this way, to get a frame, wherein a sheet of paper may be put in or taken out at pleasure; for if the paper be single, the image of an object will be seen almost as plainly on the back as on the fore-side; and by standing behind the screen, the shade of the hand will not obstruct the light in drawing, as it must in some degree when one stands before it." This construction, however, has now become rather obsolete, and is superseded by the following.

II. *The improved Solar Microscope as used with the improved single Microscope, with teeth and pinion.* Fig. 22. represents the whole form of the *single microscope;* the parts of which are as follows: ABCD the external tube; GHIK the internal moveable one; QM part of another tube within the last, at one end of which is fixed a plate of brass hollowed in the middle, for receiving the glass tubes: there is also a moveable flat plate between which, and the fixed end of the second tube, the ivory sliders are to be placed. L, a part of the microscope, containing a wire spiral spring, keeping the tube QM with its plates firm against the fixed part IK of the second tube.

EF is the small rack-work of teeth and pinion, by which the tube IG is moved gradually to or from the end AB, for adjusting the objects exactly to the focus of different lengths. NO is a brass slider, with six magnifiers; any one of which may easily be placed before the object. It is known when either of the glasses is in the centre of the eye-hole, by a small spring falling into a notch in the side of the slider, made against each of the glasses. Those parts of the apparatus, fig. 14. (Pl.ccxcix.) marked n° 15, 16, 17, 18, 19, 20, 21. and 22. are made use of here to this microscope. GH is a brass cell, which holds an illuminating glass for converging the sun's beams or the light of a candle strongly upon the objects. The aperture of the glass is made greater or less, by two circular pieces of brass, with holes of different sizes, that are screwed separately over the said lens. But at times, objects appear best when the microscope is held up to the common light only, without this glass. It is also taken away when the microscope is applied to the apparatus now to be described.

Fig. 23. represents the apparatus, with the single microscope screwed to it, which constitutes the *Solar Microscope.* AB is the inner moveable tube, to which the single microscope is screwed. CD, is the external tube, containing a condensing convex glass at the end D, and is screwed into the plate EF, which is cut with teeth at its circumference, and moved by the pinion I, that is fixed with the plate GH. This plate is screwed fast against the window-shutter, or board fitted to a convenient window of a darkened room, when the instrument is used. KL is a long frame, fixed to the circular plate EF; containing a looking-glass or mirror for reflecting the solar rays through the lens in the body of the tube D. O is a brass milled head, fastened to a worm or endless screw; which on the outside turns a small wheel, by which the reflecting mirror M is moved upwards or downwards.

In *using* this microscope, the square frame GH is first to be screwed to the window-shutter, and the room well darkened: which is best done by cutting a round hole of the size of the moveable plate EF, that carries the reflector, in the window-shutter or board; and, by means of two brass nuts *a a*, let into the shutter to receive the screws PP, when placed through the holes in the square frame GH, at the two holes QQ; which will firmly fasten the microscope to the shutter, and is easily taken away by only unscrewing the screws PP.

The white paper screen, or white cloth, to receive the images, is to be placed several feet distant from the window: which will make the representations the larger in proportion to the distance. The usual distances are from 6 to 16 feet,

The frame KL, with its mirror M, is to be moved by turning the pinion I, one way or the other, till the beams of the sun's light come through the hole into the room: then, by turning of the worm at O, the mirror must be raised or depressed till the rays become perfectly horizontal, and go straight across the room to the screen. The tube CD, with its lens at D, is now to be screwed into the hole of the circular plate EF: by this glass the rays will be converged to a focus; and from thence proceed diverging to the screen, and there make a large circle of light. The single microscope, fig. 22. is to be screwed on to the end AB (fig. 23.) of the inner tube; and the slider NO, with either of the lenses marked 1, 2, 3, 4, 5, or 6, in the centre of the hole at the end AB. This will occasion a circle of light upon the screen much larger than before. The slider or glass-tube, with the objects to be viewed, is to be placed between the plates at IK against the small magnifier, and moved at pleasure. By shifting the tube AB in or out, you may place the object in such a part of the condensed rays as shall be sufficient to illuminate it, and not scorch or burn it; which will generally require the glass to be about one inch distant from the focus. It now remains only to adjust the object, or to bring it so near to the magnifier that its image formed upon the screen shall be the most distinct or perfect: and it is effected by gently turning the pinion F, fig. 22, a small matter one way or the other. If the object be rather large in size, the least magnifiers are generally used, and *vice versa.*

N° 1. is the greatest magnifier, and n° 6. the least, in the brass slider NO. But, if desired, single lenses of greater magnifying powers are made: and they are applied, by being screwed to the end AB, fig. 22. and the brass slider N O is then taken away.

The same object may be variously magnified, by the lenses severally applied to it; and the degree of magnifying power is easily known by this rule: *As the distance of the object is to that of its image from the magnifier; so is the length and breadth of the object to that of the image.*

Instead of the brass sliders with the lenses NO, there is sometimes screwed a lens of a large size, and longer focal distance: the instrument is then converted into a *megalascope;* and is adapted for viewing the larger kind of objects contained in large sliders, such as is represented at R. And in the same manner, small objects of entertainment, painted upon glass like the sliders of a magic lanthorn, are much magnified, and represented upon the same screen.

The solar microscopes just described are capable only

MICROSCOPE.

Fig. 25

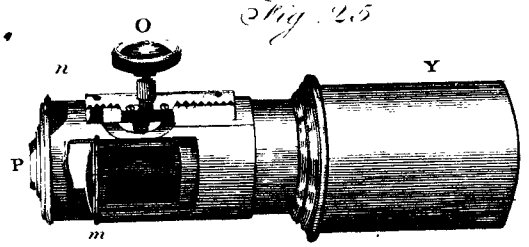


Fig. 21

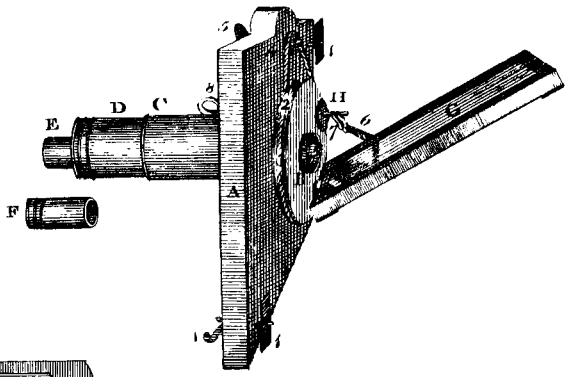
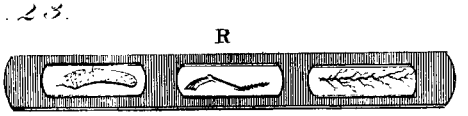


Fig. 23.



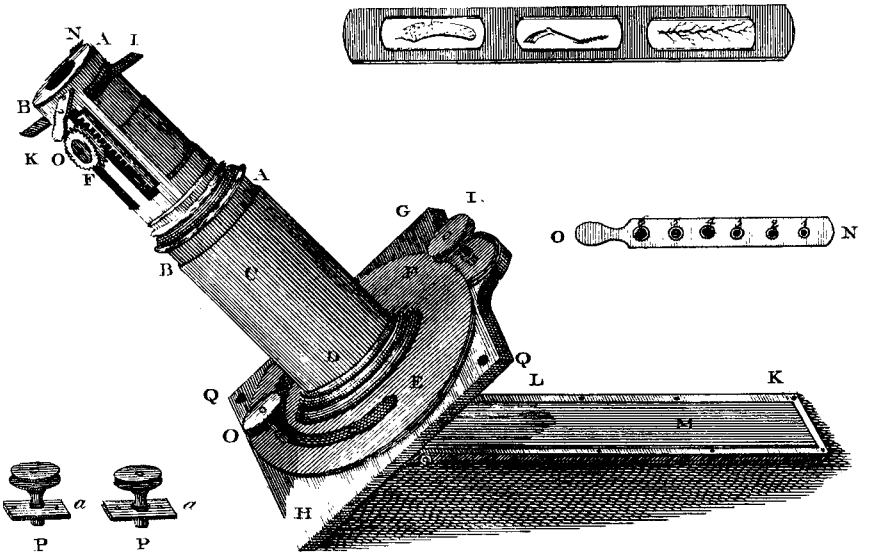


Fig. 22.

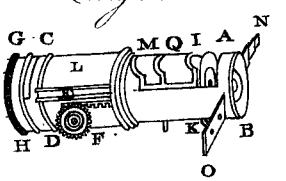
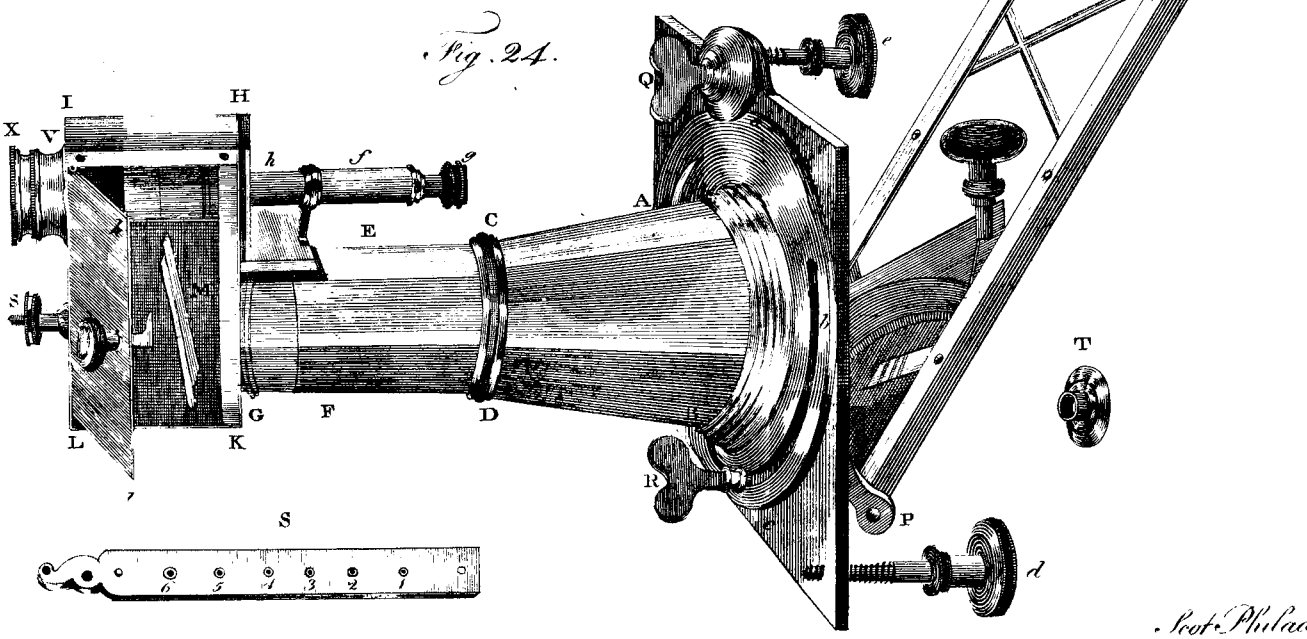


Fig. 24.



Scot. Philad.a

ly of magnifying transparent objects; for which purpose the last instrument is extremely well adapted. But as opaque objects form the most considerable part of the curious collections in the works of art as well as nature, a solar microscope for this purpose was a long time wanted.—For several years previous to 1774, the late Mr Martin made several essays towards the construction of such an instrument; and at last completed one about the time just mentioned, which he named,

III. *The Opaque Solar Microscope.* With this instrument (to use his own words) all *opaque* objects, whether of the animal, vegetable, or mineral kingdom, may be exhibited in great perfection, in all their native beauty: the lights and shades, the prominences and cavities, and all the varieties of different hues, tints and colours; heightened by reflection of the solar rays condensed upon them."—*Transparent objects* are also shown with greater perfection than by the common solar microscope.

Fig. 24. represents the solar opaque microscope, mounted for exhibiting opaque objects.

Fig. 25. is the single tooth-and-pinion microscope, as before, which is used for showing transparent objects; the cylindrical tube Y thereof being made to fit into the tube FE of the solar microscope.

ABCDEF, (fig. 24.) represents the body of the solar microscope; one part thereof, ABCD, is conical; the other, CDEF, is cylindrical. The cylindrical part receives the tube G of the opaque box, or the tube Y of the single microscope. At the large end AB of the conical part, there is a lens to receive the rays from the mirror, and refract them towards the box HIKL. NOP is a brass frame; which is fixed to the moveable circular plate *a b c*: in this frame there is a plane mirror, to reflect the solar rays on the aforementioned lens. This mirror may be moved into the most convenient position for reflecting the light, by means of the nuts Q and R. By the nut Q it may be moved from east to west; and it may be elevated or depressed by the nut R. *d e*, Two screws to fasten the microscope to a window-shutter. The box for opaque objects is represented at HIKL: it contains a plane mirror M, for reflecting the light which it receives from the large lens to the object, and thereby illuminating it; S is a screw to adjust this mirror, or place it at a proper angle for reflecting the light. VX, two tubes of brass, one sliding within the other, the exterior one in the box HIKL; these carry the magnifying lenses: the interior tube is sometimes taken out, and the exterior one is then used by itself. Part of this tube may be seen in the plate within the box HIKL. At H there is a brass plate, the back part of which is fixed to the hollow tube *h*, in which there is a spiral wire, which keeps the plate always bearing against the side H of the brass box HIKL. The sliders, with the opaque objects, pass between this plate and the side of the box; to put them there, the plate is to be drawn back by means of the nut *g*: *i k* is a door to one side of the opaque box. The foregoing pieces constitute the several parts necessary for viewing opaque objects. We shall now proceed to describe the single microscope, which is used for transparent objects: but in order to examine these, the box HIKL must be first removed, and in its place we must insert the tube Y of the single microscope that we are now going to describe.

Fig. 25. represents a large tooth-and-pinion microscope: at *m*, within the body of this microscope, are two thin plates, that are to be separated, in order to let the ivory sliders pass between them; they are pressed together by a spiral spring, which bears up the under plate, and forces it against the upper one.

The slider S (under fig. 24.), which contains the magnifiers, fits into the hole *n*; and any of the magnifiers may be placed before the object, by moving the aforesaid slider: when the magnifier is at the centre of the hole P, a small spring falls into one of the notches which is on the side of the slider.

Under the plate *m* are placed two lenses, for enlarging the field of view on the screen: the smaller of the two is fixed in a piece of brass, and is nearest the plate *m*; this is to be taken out when the magnifiers, N° 4, 5, or 6 are used, or when the megalascope lens T (fig. 24.) is used; but is to be replaced for N° 1, 2, 3.

This microscope is adjusted to the focus by turning the milled nut O.

To *use* the solar microscope:—Make a round hole in the window-shutter, a little larger than the circle *a b c*; pass the mirror ONP through this hole, and apply the square plate to the shutter; then mark with a pencil the places which correspond to the two holes through which the screw is to pass; take away the microscope, and bore two holes at the marked places, sufficiently large to let the milled screws *d e* pass through them.

The screws are to pass from the outside of the shutter, to go through it; and being then screwed into their respective holes in the square plate, they will when screwed home, hold it fast against the inside of the shutter, and thus support the microscope.

Screw the conical tube ABCD to the circle *a b c*, and then slide the tube G of the opaque box into the cylindrical part CD EF of the body, if opaque objects are to be examined; but if they be transparent objects you mean to show, then place the tube Y within the tube CDEF.

The room is to be darkened as much as possible, that no light may enter but what passes through the body of the microscope; for, on this circumstance, together with the brightness of the sun shine, the perfection and distinctness of the image in a great measure depend.

When the microscope is to be used for opaque objects, 1. Adjust the mirror NOP, so as to receive the solar rays, by means of the two finger screws or nuts, Q R; the first, Q, turns the mirror to the right or left; the second R, raises or depresses it; this you are to do till you have reflected the sun's light through the lens at AB strongly upon a screen of white paper placed at some distance from the window, and formed thereon a round spot of light. An unexperienced observer will find it more convenient to obtain the light by forming this spot before he puts on either the opaque box or the tooth-and-pinion microscope.

Now put in the *opaque* box, and place the object between the plates at H; open the door *i k*, and adjust the mirror M till you have illuminated the object strongly. If you cannot effect this by the screw S, you

Microscope you must move the screws Q, R, in order to get the light reflected strongly from the mirror NOP, or the mirror M, without which the latter cannot illuminate the object.

The object being strongly illuminated, shut the door *i k*, and a distinct view of the object will soon be obtained on your screen, by adjusting the tubes VX, which is effected by moving them backwards or forwards.

A round spot of light cannot always be procured in northern latitudes, the altitude of the sun being often too low; neither can it be obtained when the sun is directly perpendicular to the front of the room.

As the sun is continually changing its place, it will be necessary, in order to keep his rays full upon the object, to keep them continually directed thro' the axis of the instrument, by the two screws Q and R.

To view *transparent* objects, remove the opaque box, and insert the tube Y, fig. 25. in its place; put the slider S into its place at *n*, and the slider with the objects between the plates at *m*; then adjust the mirror NOP, as before directed by the screws Q, R, so that the light may pass through the object; regulate the focus of the magnifier by the screw O. The most pleasing magnifiers in use are the fourth and fifth.

The size of the object may be increased or diminished, by altering the distance of the screen from the microscope: five or six feet is a convenient distance.

To examine transparent objects of a larger size, or to render the instrument what is usually called a *megalascope*, take out the slider S from its place at *n*, and screw the button T (fig. 24.) into the hole at P, fig. 25 and remove the glass which is under the plate at *m*, and regulate the light and focus agreeable to the foregoing directions.

N. B. At the end of the tube G there is a lens for increasing the density of the rays, for the purpose of burning or melting any combustible or fusible substance: this lens must be removed in most cases lest the objects should be burnt. The intensity of the light is also varied by moving this tube backwards or forwards.

Apparatus of the Opaque Solar Microscope.—The large square plate and mirror; the body of the microscope; the opaque box and its tube; the tooth-and pinion microscope; the slider with the magnifiers; the megalascope magnifier; the two screws *d* and *e*; some ivory sliders; some sliders with opaque objects; a brass frame, with a bottom of soft deal to stick any object on; a brass cylinder K (fig. 31.), for confining opaque objects.

IV. *The* Camera Obscura, *or* Lucernal, *Microscope.*

—The great facility with which objects can be represented on paper or a rough glass in the camera obscura, and copies drawn from them by any person though unskilled in drawing, evidently suggested the application of the microscope to this instrument. The greatest number of experiments that appear to have been made with this view, were by the late Mr Martin and Mr Adams; the former of whom frequently applied the microscope to the portable camera and with much effect and entertainment. But these instruments being found to answer only with the assistance of the sun, Mr Adams directed his experiments to the construction of an instrument of more extended utility, which could be equally employed in the day-time and by night. He accordingly succeeded so far as to produce, by *candle-light* the images of objects refracted from a single magnifier upon one or two large convex lenses (of about five inches or upwards in diameter), at the end of a pyramidal shaped box, in a very pleasing and magnified appearence, so as to give opaque objects as well as transparent ones the utmost distinctness of representation; but still the light of a candle or lamp was found generally insufficient to throw the requisite degree of illumination upon the objects. The invention of what is called *Argand's lamp*, within these few years offered a complete remedy for this defect, by the intensity and steadiness of its light. This did not escape the present Mr Adams (son of the former), who immediately applied it; and who had likewise so altered and improved his father's instrument, both in construction and form, as to render it altogether a different one, and far more perfect and useful.

The advantages and properties of this excellently conceived instrument are numerous and important. "As the far greater part of the objects which surround us are opaque (says our author), and very few are sufficiently transparent to be examined by the common microscopes, an instrument that could be readily applied to the examination of opaque objects has always been a desideratum. Even in the examination of transparent objects, many of the fine and more curious portions are lost and drowned, as it were, in the light which must be transmitted through them; while different parts of the same object appear only as dark lines or spots, because they are so opaque as not to permit any light to pass through them. These difficulties, as well as many more, are obviated in the lucernal microscope; by which opaque objects of various sizes may be seen with ease and distinctness: the beautiful colours with which most of them are adorned, are rendered more brilliant, without changing in the least the real tint of the colour; and the concave and convex parts retain also their proper form.—The facility with which all opaque objects are applied to this instrument, is another considerable advantage, and almost peculiar to itself; as the texture and configuration of the more tender parts are often hurt by previous preparation, every object may be examined by this instrument, first as opaque, and afterwards (if the texture will admit of it) as transparent.—The lucernal microscope does not in the least fatigue that eye; the object appears like nature itself, giving ease to the sight and pleasure to the mind: there is also, in the use of this instrument, no occasion to shut the eye which is not directed to the object. A further advantage peculiar to this microscope is, that by it the outlines of every object may be taken, even by those who are not accustomed to draw; while those who can draw well will receive great assistance, and execute their work with more accuracy and in less time than they would otherwise have been able to have performed it. Transparent objects as well as opaque may be copied in the same manner. The instrument may be used at any time of the day, but the best effect is by night; in which respect it has a superiority over the solar microscope, as that instrument can only be used when the sun shines.

Tran-

Microscope

Transparent objects may be examined with the lucernal microscope in three or four different modes, from a blaze of light almost too great for the eye to bear, to that which is perfectly easy to it: And by the addition of a tin lanthorn to the apparatus, may be thrown on a screen, and exhibited at one view to a large company, as by the solar microscope.

We shall now proceed to the description of the instrument and apparatus as given by Mr Adams.

Fig. 26. represents the improved *Lucernal Microscope*, mounted to view opaque objects. ABCD is a large mahogany pyramidal box, which forms the body of the microscope, it is supported firmly on the brass pillar FG, by means of the socket H and the curved piece IK.

LMN is a guide for the eye, in order to direct it in the axis of the lenses; it consists of two brass tubes, one sliding within the other, and a vertical flat piece, at the top of which is the hole for the eye. The outer tube is seen at MN, the vertical piece is represented at LM. The inner tube may be pulled out, or pushed in, to adjust it to the focus of the glasses. The vertical piece may be raised or depressed, that the hole, through which the object is to be viewed, may coincide with the centre of the field of view; it is fixed by a milled screw at M, which could not be shown in this figure.

At N is a dove-tailed piece of brass, made to receive the dove tail at the end of the tubes MN, by which it is affixed to the wooden box ABCDE. The tubes MN may be removed from this box occasionally, for the convenience of packing it up in a less compass.

OP, a small tube which carries the magnifiers.

O, one of the magnifiers; it is screwed into the end of a tube, which slides within the tube P; the tube P may be unscrewed occasionally from the wooden body.

QRSTVX, a long square bar, which passes through the sockets YZ, and carries the stage or frame that holds the objects; this bar may be moved backward or forward, in order to adjust it to the focus by means of the pinion which is at *a*.

b, A handle furnished with an universal joint, for more conveniently turning the pinion. When the handle is removed, the nut (fig. 27.) may be used in its stead.

d e, A brass bar, to support the curved piece KI, and keep the body AB firm and steady.

f g h i, The stage for opaque objects: it fits upon the bar QRST by means of the socket *h i*, and is brought nearer to or removed farther from the magnifying lens by turning the pinion *a*: the objects are placed in the front side of the stage (which cannot be seen in this figure) between four small brass plates; the edges of two of these are seen at *k l*. The two upper pieces of brass are moveable; they are fixed to a plate, which is acted on by a spiral spring, that presses them down, and confines the slider with the objects: this plate, and the two upper pieces of brass are lifted up by the small nut *m*.

At the lower part of the stage, there is a semicircular lump of glass *n*, which is designed to receive the light from the lamp, fig. 29. and to collect and throw it on the concave mirror *o*, whence it is to be reflected on the object.

The upper part *f g r s* (fig. 26.) of the opaque stage takes out, that the stage for transparent objects may be inserted in its place.

Fig. 28. represents the stage for transparent objects; the two legs 5 and 6 fit into the top of the under part *r s h i* of the stage for opaque objects; 7 is the part which confines or holds the sliders, and through which they are to be moved; 9 and 10 a brass tube, which contains the lenses for condensing the light, and throwing it upon the object; there is a second tube within that, marked 9 and 10, which may be placed at different distances from the object by the pin 11.

When this stage is used as a single microscope, without any reference to the lucernal, the magnifiers, or object lenses, are to be screwed into the hole 12, and to be adjusted to a proper focus by the nut 13.

N. B. At the end AB (fig 26.) of the wooden body there is a slider, which is represented as partly drawn out at A: when quite taken out, three grooves will be perceived; one of which contains a board that forms the end of the box; the next contains a frame with a greyed glass; and the third, or that farthest from the end AB, two large convex lenses.

Fig. 29. represents one of Argand's lamps, which are the most suitable for microscopic purposes, on account of the clearness, the intensity, and the steadiness of the light. The following account of the method of managing them, with other observations, is copied from an account given by Mr Parker with those he sells.

The principle on which the lamp acts, consists in disposing the wick in thin parts, so that the air may come into contact with all the burning fuel; by which means, together with an increase of the current of air occasioned by rarefaction in the glass tube, the whole of the fuel is converted into flame.

The wicks are circular; and, the more readily to regulate the quantity of light, are fixed on a brass collar, with a wire handle, by means of which they are raised or depressed at pleasure.

To fix the wick on, a wooden mandril is contrived, which is tapered at one end, and has a groove turned at the other.

The wick has a selvage at one end, which is to be put foremost on the mandril, and moved up to the groove; then putting the groove into the collar of the wick-holder, the wick is easily pushed forward upon it.

The wick-holder and wick being put quite down in their place, the spare part of the wick should, while dry, be set a-light, and suffered to burn to the edge of the tubes; this will leave it more even than by cutting, and, being black by burning, will be much easier lighted: for this reason, the black should never be quite cut off.

The lamp should be filled an hour or two before it is wanted, that the cotton may imbibe the oil and draw the better.

The lamps which have a reservoir and valve, need no other direction for filling than to do it with a proper trimming pot, carefully observing when they are full; then pulling up the valve by the point, the reservoir, being turned with the other hand, may be replaced without spilling a drop.

Those lamps which fill in the front like a bird-fountain, must be reclined on the back to fill; and this

should be done gently, that the oil in the burner may return into the body when so placed and filled: if, by being too full, any oil appears above the guard, only move the lamp a little, and the oil will disappear; the lamp may then be placed erect, and the oil will flow to its proper level.

The oil must be of the spermaceti kind, commonly called chamber-oil, which may generally be distinguished by its paleness, transparency, and inoffensive scent: all those oils which are of a red and brown colour, and of an offensive scent, should be carefully avoided as their glutinous parts clog the lamp, and the impurities in such oil, not being inflammable, will accumulate and remain in the form of a crust on the wick. Seal oil is nearly as pale and sweet as chamber oil; but being of a heavy sluggish quality, is not proper for lamps with fine wicks

Whenever bad oil has been used, on changing it, the wick must also be changed; because, after having imbibed the coarse particles in its capillary tubes it, will not draw up the fine oil.

To obtain the greatest degree of light, the wick should be trimmed exactly even, the flame will then be completely equal.

There will be a great advantage in keeping the lamp clean, especially the burner and air-tubes; the neglect of cleanliness in lamps is too common: a candlestick is generlly cleaned every time it is used, so should a lamp; and if a candlestick is not to be objected to because it does not give light after the candle is exhausted, so a lamp should not be thought ill of, if it does not give light when it wants oil or cotton; but this last has often happened, because the deficiency is less visible.

The glass tubes are best cleaned with a piece of wash leather.

If a fountain-lamp is left partly filled with oil, it may be liable to overflow; this happens by the contraction of the air when cold, and its expansion by the warmth of a room, the rays of the sun, or the heat of the lamp when re-lighted: this accident may be effectually prevented by keeping the reservoir filled, the oil not being subject to expansion like air. On this account, those with a common reservoir are best adapted for microscopic purposes.

To examine Opaque Objects with the Lucernal Microscope. To render the use of this instrument easy, it is usually packed with as many of the parts together as possible: it occupies on this account rather more room, but is much less embarrassing to the observer, who has only three parts to put on after it is taken out of its box, namely, the guide for the eye, the stage, and the tube with its magnifier.

But to be more particular: Take out the wooden slider A (fig. 26.), then lift out the cover and the grey glass from their respective grooves under the slider A.

Put the end N of the guide for the eye LMM into its place, so that it may stand in the position which is represented in this figure.

Place the socket which is at the bottom of the opaque stage, on the bar QXT, so that the concave mirror *o* may be next the end DE of the wooden body.

Screw the tubes PO into the end DE. The magnifier you intend to use is to be screwed on the end O of these tubes.

The handle G*b*, or the milled nut fig. 27. must be placed on the square end of the pinion *a*.

Place the lamp lighted before the glass lump *n*, and the object you intend to examine between the spring-plates of the stage; and the instrument is ready for use.

In all microscopes are there two circumstances which must be particularly attended to: first, the modification of the light, or the proper quantity to illuminate the object; secondly, the adjustment of the instrument to the focus of the glasses and eye of the observer. In the use of the lucernal microscope there is a third circumstance, which is, the regulation of the guide for the eye.

1. To throw the light upon the object. The flame of the lamp is to be placed rather below the centre of the glass lump *n*, and as near it as possible; the concave mirror *o* must be so inclined and turned as to receive the light from the glass lump, and reflect it thence upon the object; the best situation of the concave mirror and the flame of the lamp depends on a combination of circumstances, which a little practice will discover.

2. To regulate the guide for the eye, or to place the centre of the eye-piece L so that it may coincide with the focal point of the lenses and the axis of vision: Lengthen and shorten the tubes MN, by drawing out or pushing in the inner tube, and raising or depressing the eye-piece ML, till you find the large lens (which is placed at the end AB of the wooden body) filled by an uniform field of light, without any prismatic colours round the edge; for till this piece is properly fixed, the circle of light will be very small, and only occupy a part of the lens: the eye must be kept at the centre of the eye piece L, during the whole of the operation; which may be rendered somewhat easier to the observer, on the first use of the instrument, if he hold a piece of white paper parallel to the large lens, removing it from or bringing it nearer to them till he find the place where a lucid circle, which he will perceive on the paper, is brightest and most distinct; then he is to fix the centre of the eye-piece to coincide with that spot; after which a very small adjustment will set it perfectly right.

3. To adjust the lenses to their focal distance. This is effected by turning the pinion *a*, the eye being at the same time at the eye-piece L. The grey glass is often placed before the large lenses, while regulating the guide for the eye, and adjusting for the focal distance.

If the observer, in the process of his examination of an object, advance rapidly from a shallow to a deep magnifier, he will save himself some labour by pulling out the internal tube at O.

The upper part *f g r s* of the stage is to be raised or lowered occasionally, in order to make the centre of the object coincide with the centre of the lens at O.

To delineate objects, the grey glass must be placed before the large lenses; the picture of the object will be formed on this glass, and the outline may be accurately taken by going over the picture with a pencil.

The

Fig. 26.

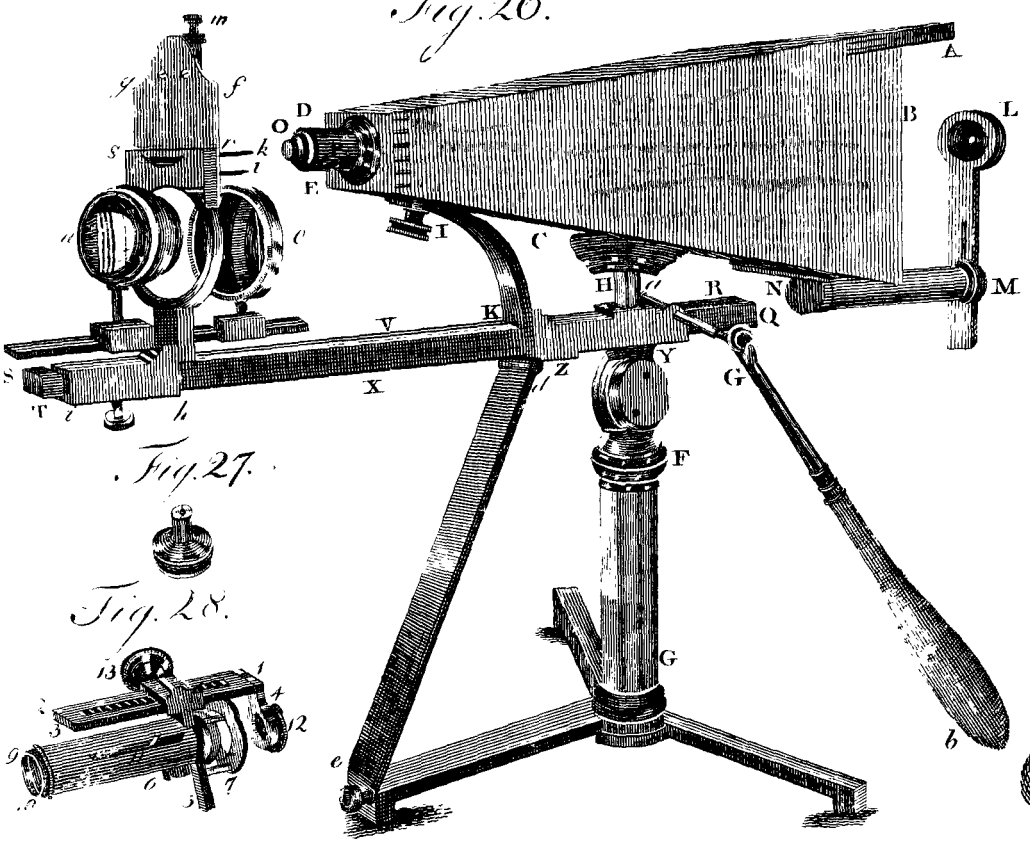


Fig. 29.

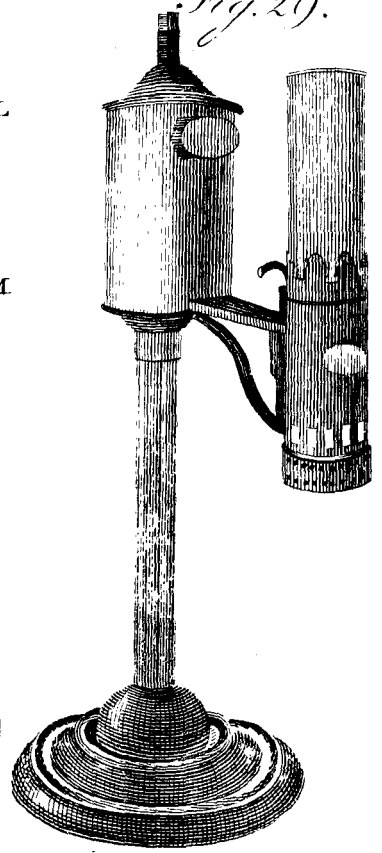


Fig. 27.

Fig. 28.

Fig. 30.

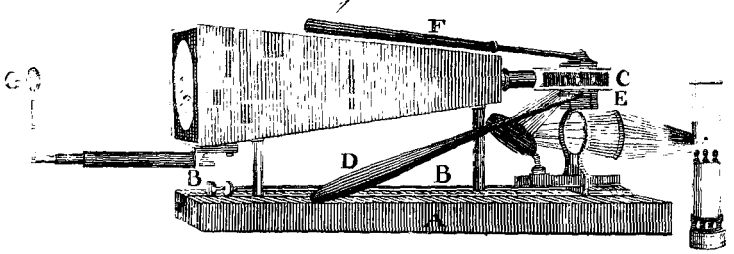
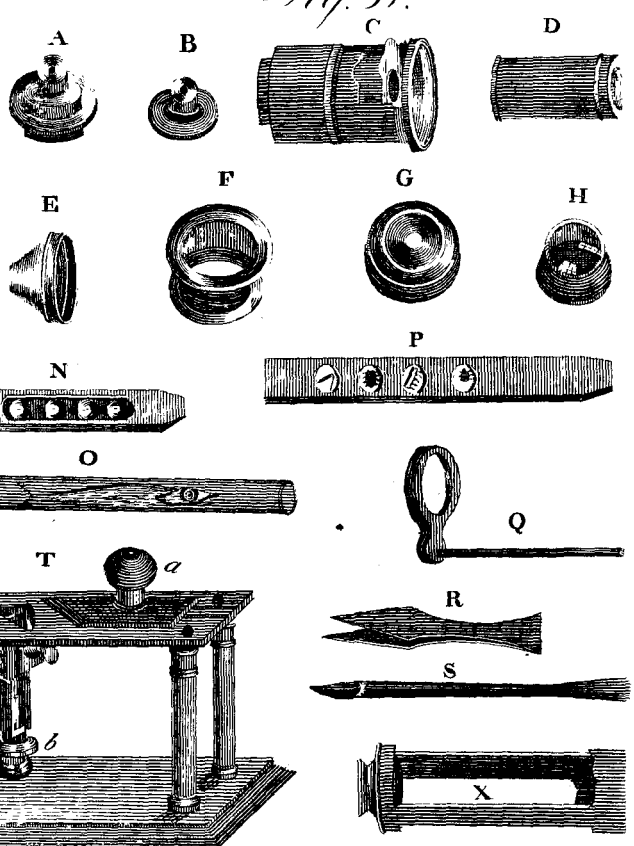


Fig. 31.



Trenchard

The opaque part may be used in the day-time without a lamp, provided the large lenses at A B are screened from the light.

To use the Lucernal Microscope in the examination of Transparent Objects. The instrument is to remain as before: the upper part *f g s* of the opaque stage must be removed, and the stage for transparent objects, represented at fig. 28. put in its place; the end 9 10 to be next the lamp.

Place the greyed glass in its groove at the end A B, and the objects in the slider-holder at the front of the stage; then transmit as strong a light as you are able on the object, which you will easily do by raising or lowering the lamp.

The object will be beautifully depicted on the grey glass: it must be regulated to the focus of the magnifier, by turning the pinion *a*.

The object may be viewed either with or without the guide for the eye. A single observer will see an object to the greatest advantage by using this guide, which is to be adjusted as we have described above. If two or three wish to examine the object at the same time, the guide for the eye must be laid aside.

Take the large lens out of the groove, and receive the image on the grey glass; in this case, the guide for the eye is of no use: if the grey glass be taken away, the image of the object may be received on a paper screen.

Take out the grey glass, replace the large lenses, and use the guide for the eye; attend to the foregoing directions, and adjust the object to its proper focus. You will then see the object in a blaze of light almost too great for the eye, a circumstance that will be found very useful in the examination of particular objects. The edges of the object in this mode will be somewhat coloured: but as it is only used in this full light for occasional purposes, it has been thought better to leave this small imperfection, than, by remedying it, to sacrifice greater advantages; the more so, as this fault is easily corrected, and a new and interesting view of the object is obtained, by turning the instrument out of the direct rays of light, and permitting them to pass through only in an oblique direction, by which the upper surface is in some degree illuminated, and the object is seen partly as opaque, partly as transparent. It has been already observed, that the transparent objects might be placed between the slider-holders of the stage for opaque objects, and then be examined as if opaque.

Some transparent objects appear to the greatest advantage when the lens at 9 10 is taken away; as, by giving too great a quantity of light, it renders the edges less sharp.

The variety of views which may be taken of every object by means of the improved lucernal microscope, will be found to be of great use to an accurate observer: it will give him an opportunity of correcting or confirming his discoveries, and investigating those parts in one mode which are invisible in another.

To throw the image of transparent objects on a screen, as in the solar microscope. It has been long a microscopical desideratum, to have an instrument by which the image of transparent objects might be thrown on a screen, as in the common solar microscope: and this not only because the sun is so uncertain in this climate, and the use of the solar microscope requires confinement in the finest part of the day, when time seldom hangs heavy on the mind; but as it also affords an increase of pleasure, by displaying its wonders to several persons at the same instant, without the least fatigue to the eye.

This purpose is now effectually answered, by affixing the transparent stage of the lucernal to a lanthorn, with one of Argand's lamps.—The lamp is placed within the lanthorn, and the end 9 10 of the transparent stage is screwed into a female screw, which is rivetted in the sliding part of the front of the lanthorn; the magnifying lenses are to be screwed into the hole represented at 12, and they are adjusted by turning the milled nut. The quantity of light is to be regulated by raising and lowering the sliding-plate or the lamp.

Apparatus which usually accompanies the improved Lucernal Microscope. The stage for opaque objects, with its semicircular lump of glass, and concave mirror. The stage for transparent objects, which fits on the upper part of the foregoing stage. The sliding tube, to which the magnifiers are to be affixed: one end of these is to be screwed on the end D of the wooden body; the magnifier in use is to be screwed to the other end of the inner tube. Eight manifying lenses: these are so constructed, that they may be combined together, and thus produce a very great variety of magnifying powers. A fish-pan, such as is represented at I. A steel wire L, with a pair of nippers at one end, and a small cylinder of ivory *l* at the other. A slider of brass N, containing a flat glass slider, and a brass slider into which are fitted some small concave glasses. A pair of forceps. Six large and six small ivory sliders, with transparent objects. Fourteen wooden sliders, with four opaque objects in each slider; and two spare sliders. Some capillary tubes for viewing small animalcula.

Ingenious men seldom content themselves with an instrument under one form; hence such a variety of microscopes, hence many alterations in the Lucernal Microscope. Mr Adams himself, we understand, has fitted up this last in a great many different ways; and it is reasonable to think that no person is more likely to give it every improvement of which it is susceptible. Of the alterations by other hands we shall only particularise one, made by Mr Jones of Holborn (B), whose description is as follows:

A, represents a portion of the top of the mahogany box

(B) We trust the reader will never consider any paragraph wherein the name of an instrument-maker or other artist is inserted, as a recommendation of those artists by the editors of this work. In the course of a pretty extensive correspondence, they have been favoured with very liberal communications from various artists, for which they are greatly indebted to them: the inserting their names in this work is therefore to be considered as a grateful acknowledgment from the editors for favours conferred on them,—not as a testimonial

box in which it packs, to preserve it steady; it slides in a dove-tail groove withinside, a similar groove to which is cut in the top of the box A; so that when the instrument is to be used, it is slipt out of the box withinside, and then slipt into the groove at top ready for use, almost instantly, as shown in the figure. The adjustment of the objects is at the stage E; for the right focal distance is readily and conveniently made by turning the long screw-rod B B, which goes thro' the two pillars supporting the box, and works in the base of the brass stage E; which base is also dove-tailed, so as to have a regular and steady motion in another brass basis that supports it. In this instrument, therefore, the pyramidical box does not move; but the stage part only, which, from its small weight, moves in the most agreeable and steady manner. While observing the image of the object upon the glass through the sight-hole at G, the object may be moved or changed by only turning the rack-work and pinion applied to the stage, by means of the handle D, for that purpose. By this contrivance you have no occasion to change your position during the view of the objects upon one of the sliders. This motion changes the objects horizontally only; and as they are generally placed exactly in one line, it answers all the purposes for which this motion is intended very well. But it may sometimes happen that the observer would wish to alter the vertical position of the object; to perform which there is another plane rod at F, that acts simply as a lever for this purpose, and moves the sliding part of the stage E vertically either upwards or downwards.

Thus, without altering his position, the observer may investigate all parts of the objects in the most satisfactory manner. Rack-work and pinion might be applied to the stage for the vertical motion also; but as it would materially enhance the expence, it is seldom applied. The brass work at the handle of D contains a Hooke's universal joint.

The brilliancy of the images of the objects shown upon the large lenses at the end of the box, being very frequently so great as to dazzle the eyes, Mr Jones applies a slight tinge of blue, green, and other coloured glass, to the sight-hole at G, which softens this glare, and casts an agreeable hue upon the objects.

Description of those Parts of a Microscopical Apparatus, common to most Instruments, which are delineated at fig. 31.

A and B represent the brass cells which contain the magnifiers belonging to the different kinds of compound microscopes. The magnifiers are sometimes contained in a slider like that which is delineated at S (fig. 24). The lenses of A and B are confined by a small cap; on unscrewing this, the small lens may be taken out and cleaned. The magnifiers A of the lucernal microscope are so contrived, that any two of them may be screwed together, by which means a considerable variety of magnifying power is obtained.

To get at the lenses in the slider S (fig. 24.), take out the two screws which hold on the cover.

C, represents the general form of the slider-holder. It consists of a cylindrical tube, in which an inner tube is forced up by a spring. It is used to receive the ivory or any other slider, in which the transparent objects are placed; these are to be slid between the two upper plates: the hollow part in one of the plates is designed for the glass tubes.

D, the condensing lens and its tube, which fits into the slider-holder C, and may be moved up and down in it. When this piece is pushed up as far as it will go, it condenses the light of a candle, which is reflected on it by the plain mirror of the compound microscope, and spreads it uniformly over the object; in this case it is best adapted to the shallowest magnifiers. If the deeper lenses are used, it should be drawn down, or rather removed further from the object, that it may concentrate the light in a small compass, and thus render it more dense. The condensing lens is sometimes fitted up differently; but the principle being the same, it will be easy to apply it to use notwithstanding some variations in the mechanism.

E, a brass cone. It fixes under the slider-holder, and is used to lessen occasionally the quantity of light which comes from the mirror to any object.

F, a box with two flat glasses, which may be placed at different distances from each other in order to confine a small living insect.

G, a small brass box to hold the silver speculum H.

H, a small silver concave speculum, designed to reflect the light from the mirror on opaque objects; it should only be used with the shallow magnifiers. It is applied in different ways to the compound microscope; sometimes to a tube similar to that represented at X, which slides on the lower part of the body; sometimes it is screwed into the ring of the piece Q; the pin of this generally fits into one of the holes in the stage. When this speculum is used, the slider-holder should be removed.

I, a fish-pan, whereon a small fish may be fastened, in order to view the circulation of the blood: its tail is to be spread across the oblong hole at the smallest end, and tied fast by means of the ribbon fixed thereto, by shoving the knob which is on the back of it through the slit made in the stage; the tail of the fish may be brought under the lens which is in use.

K, a cylindrical piece, intended for the solar opaque microscope: by pulling back the spiral spring, smaller or larger objects may be confined in it.

k, A pair of triangular nippers for taking hold of and confining a large object.

L, a long steel wire, with a small pair of pliers at one end and a steel point at the other: the wire slips backwards or forwards in a spring tube, which is affixed to a joint, at the bottom of which is a pin to fit one of the holes in the stage; this piece is used to confine small objects.

l, A small ivory cylinder that fits on the pointed end of the steel wire L; it is designed to receive opaque objects. Light-coloured ones are to be stuck on the dark side, and *vice versa*.

M, a convex lens, which fits to the stage by means of

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nial of their opinion of the abilities of an individual, or as designed to insinuate any preference over others in the same line, where such preference has not been already bestowed by the public.

Microscope of the long pin adhering to it. This piece is designed to collect the light from the sun or a candle, and to throw them on any object placed on the stage; but it is very little used at present.

N, a brass slider, into which is fitted a flat piece of glass, and a brass slider containing four small glasses, one or two of them concave, the others flat; it is designed to confine small living objects, and when used is to be placed between the two upper plates of the slider-holder.

O, a glass tube to receive a small fish, &c.

P, represents one of the ivory sliders, wherein objects are placed between two pieces of talc, and confined by a brass ring.

Q, a piece to hold the speculum H: this piece is generally fitted to the microscope represented at fig. 12.

R, a pair of forceps, to take up any occasional object.

S, a camel's hair pencil to brush the dust off the glasses; the upper part of the quill is scooped out, to take up a drop of any fluid, and place it on either of the glasses for examination.

T, an instrument for cutting thin transverse sections of wood. It consists of a wooden base, which supports four brass pillars; on the top of the pillars is placed a flat piece of brass, near the middle of which there is a triangular hole.

A sharp knife, which moves in a diagonal direction, is fixed on the upper side of the aforementioned plate, and in such a manner that the edge always coincides with the surface thereof.

The knife is moved backwards and forwards by means of the handle *a*. The piece of wood is placed in the triangular trough which is under the brass plate, and is to be kept steady therein by a milled screw which is fitted to the trough; the wood is to be pressed forward for cutting by the micrometer screw *b*.

The pieces of wood should be applied to this instrument immediately on being taken out of the ground, or else they should be soaked for some time in water, to soften them so that they may not hurt the edge of the knife.

When the edge of the knife is brought in contact with the piece of wood, a small quantity of spirits of wine should be poured on the surface of the wood, to prevent its curling up; it will also make it adhere to the knife, from which it may be removed by pressing a piece of blotting paper on it.

y, An appendage to the cutting engine, which is to be used instead of the micrometer screw, being preferred to it by some. It is placed over the triangular hole, and kept flat down upon the surface of the brass plate, while the piece of wood is pressed against a circular piece of brass which is on the under side of it. This circular piece of brass is fixed to a screw, by which its distance from the flat plate on which the knife moves may be regulated.

z, An ivory box, containing at one end spare talc for the ivory sliders, and at the other spare rings for pressing the talcs together and confining them to the slider.

After what has been related of Microscopes, they cannot be said to complete without the valuable addition of a *micrometer*; for the use and advantages of which, see the article Micrometer.

Having presented our readers with descriptions of the various miscroscopes generally used, we think it our duty to point out to them those which we conceive to be best calculated to answer the purposes of science. The first which presents itself to our mind is that of *Ellis*: It is better adapted, than any other portable microscope, to the purpose of general observation; simple in its construction, and general in its application. To those who prefer a double microscope, we should recommend that figured in Plate CCXCVIII. (12.) If opaque objects, as insects, &c. be subjects of investigation, the *Lucernal Microscope* claims the preference: but if amusement alone guides the choice, the *Solar Microscope* must be fixed upon.

We shall now proceed to explain some necessary particulars respecting the method of using microscopes: after which, we shall subjoin an enumeration of the principal objects discovered or elucidated by their means. On this subject Mr Adams, in his *Essay on the Microscope*, has been very copious; with a view, as he informs us, to remove the common complaint made by Mr Baker, "that many of those who purchase microscopes are so little acquainted with their general and extensive usefulness, and so much at a loss for objects to examine by them, that after diverting their friends some few times with what they find in the sliders which generally accompany the instrument, or perhaps with two or three common objects, the microscope is laid aside as of little further value; whereas no instrument has yet appeared in the world capable of affording so constant, various, and satisfactory an entertainment to the mind."

I. In using the microscope, there are three things necessary to be considered. (1.) The preparation and adjustment of the instrument itself. (2.) The proper quantity of light, and the best method of adapting it to the object. (3.) The method of preparing the objects, so that their texture may be properly understood.

1. With regard to the microscope itself, the first thing necessary to be examined is, whether the glasses be clean or not: if they are not so, they must be wiped with a piece of soft leather, taking care not to soil them afterwards with the fingers; and, in replacing them, care must be taken not to place them in an oblique situation. We must likewise be careful not to let the breath fall upon the glasses, nor to hold that part of the body of the instrument where the glasses are placed with a warm hand; because thus the moisture expelled by the heat from the metal will condense upon the glass, and prevent the object from being distinctly seen. The object should be brought as near the centre of the field of view as possible; for there only it will be exhibited in the greatest perfection. The eye should be moved up and down from the eye-glass of a compound microscope, till the situation is found where the largest field and most distinct view of the object are to be had: but every person ought to adjust the microscope to his own eye, and not to depend upon the situation it was placed in by another. A small magnifying power should always

always be begun with; by which means the obſerver will beſt obtain an exact idea of the ſituation and connection of the whole; and will of conſequence be leſs liable to form any erroneous opinion when the parts are viewed ſeparately by a lens of greater power. Objects ſhould alſo be examined firſt in their moſt natural poſition: for if this be not attended to, we ſhall be apt to form very inadequate ideas of the ſtructure of the whole, as well as of the connection and uſe of the parts. A living animal ought to be as little hurt or diſcompoſed as poſſible.

From viewing an object properly, we may acquire a knowledge of its nature: but this cannot be done without an extenſive knowledge of the ſubject, much patience, and many experiments; as in a great number of caſes the images will reſemble each other, though derived from very different ſubſtances. Mr Baker therefore adviſes us not to form an opinion too ſuddenly after viewing a microſcopical object; nor to draw our inferences till after repeated experiments and examinations of the object in many different lights and poſitions; to paſs no judgment upon things extended by force, or contracted by dryneſs, or in any manner out of a natural ſtate, without making ſuitable allowances. The true colour of objects cannot be properly determined by very great magnifiers; for as the pores and interſtices of an object are enlarged according to the magnifying power of the glaſſes made uſe of, the component particles of its ſubſtance will appear ſeparated many thouſand times farther aſunder than they do to the naked eye: hence the reflection of the light from theſe particles will be very different, and exhibit different colours. It is likewiſe ſomewhat difficult to obſerve opaque objects; and as the apertures of the larger magnifiers are but ſmall, they are not proper for the purpoſe. If an object be ſo very opaque, that no light will paſs through it, as much as poſſible muſt be thrown upon the upper ſurface of it. Some conſideration is likewiſe neceſſary in forming a judgment of the motion of living creatures, or even of fluids, when ſeen through the microſcope; for as the moving body, and the ſpace wherein it moves, are magnified, the motion will alſo be increaſed.

2. On the management of the light depends in a great meaſure the diſtinctneſs of the viſion: and as, in order to have this in the greateſt perfection, we muſt adapt the quantity of light to the nature of the object and the focus of the magnifier, it is therefore neceſſary to view it in various degrees of light. In ſome objects, it is difficult to diſtinguiſh between a prominence and a depreſſion, a ſhadow or a black ſtain; or between a reflection of light and whiteneſs, which is particularly obſervable in the eye of the libella and other flies: all of theſe appearing very different in one poſition from what they do in another. The brightneſs of an object likewiſe depends on the quantity of light, the diſtinctneſs of viſion, and on regulating the quantity to the object; for ſome will be in a manner loſt in a quantity of light ſcarce ſufficient to render another viſible.

There are various ways in which a ſtrong light may be thrown upon objects; as by means of the ſun and a convex lens. For this purpoſe, the microſcope is to be placed about three feet from a ſouthern window; then take a deep convex lens, mounted on a ſemicircle and ſtand, ſo that its poſition may eaſily be varied; place this lens between the object and the window, ſo that it may collect a conſiderable number of ſolar rays, and refract them on the object or the mirror of the microſcope. If the light thus collected from the ſun be too powerful, it may be leſſened by placing a piece of oiled paper, or a piece of glaſs lightly greyed, between the object and lens. Thus a proper degree of light may be obtained, and diffuſed equally all over the ſurface of an object: a circumſtance which ought to be particularly attended to; for if the light be thrown irregularly upon it, no diſtinct view can be obtained. If we mean to make uſe of the ſolar light, it will be found convenient to darken the room, and to reflect the rays of the ſun on the abovementioned lens by means of the mirror of a ſolar microſcope fixed to the window-ſhutter; for thus the obſerver will be enabled to preſerve the light on his object, notwithſtanding the motion of the ſun. But by reaſon of this motion, and the variable ſtate of the atmoſphere, ſolar obſervations are rendered both tedious and inconvenient: whence it will be proper for the obſerver to be furniſhed with a large tin lanthorn, formed ſomething like the common magic lanthorn, capable of containing one of Argand's lamps. This, however, ought not to be of the fountain kind, leſt the rarefaction of the air in the lanthorn ſhould force the oil over. There ought to be an aperture in the front of the lanthorn, which may be moved up and down, and be capable of holding a lens; by which means a pleaſant and uniform as well as ſtrong light may eaſily be procured. The lamp ſhould likewiſe move on a rod, ſo that it may be eaſily raiſed or depreſſed. This lanthorn may likewiſe be uſed for many other purpoſes; as viewing of pictures, exhibiting microſcopic objects on a ſcreen, &c. A weak light, however, is beſt for viewing many tranſparent objects: among which we may reckon the prepared eyes of flies, as well as the animalcules in fluids. The quantity of light from a lamp or candle may be leſſened by removing the microſcope to a greater diſtance from them, or by diminiſhing the ſtrength of the light which falls upon the objects. This may very conveniently be done by pieces of black paper with circular apertures of different ſizes, and placing a larger or ſmaller one upon the reflecting mirror, as occaſion may require. There is an oblique ſituation of the mirrors, which makes likewiſe an oblique reflection of the light eaſily diſcovered by practice, (but for which no general rule can be given in theory); and which will exhibit an object more diſtinctly than any other poſition, ſhowing the ſurface, as well as thoſe parts through which the light is tranſmitted. The light of a lamp or candle is generally better for viewing microſcopic objects than day-light; it being more eaſy to modify the former than the latter, and to throw it upon the objects with different degrees of denſity.

3. With regard to the preparation of objects, Swammerdam has, in that particular, excelled almoſt all other inveſtigators who either preceded or have ſucceeded him. He was ſo aſſiduous and indefatigable, that neither difficulty nor diſappointment could make the leaſt impreſſion upon him; and he never abandoned the purſuit of any object until he had obtained

Microscope tained a satisfactory idea of it. Unhappily, however, the methods he made use of in preparing his objects for the microscope are now entirely unknown. Dr Boerhaave examined with the strictest attention all the letters and manuscripts of Swammerdam which he could find; but his researches were far from being successful. The following particulars, however, have thus come to the knowledge of the public.

For dissecting of *small insects*, Swammerdam had a brass table made by S. Muschenbroek, to which were affixed two brass arms moveable at pleasure to any part of it. The upper part of these vertical arms was constructed in such a manner as to have a slow vertical motion; by which means the operator could readily alter their height as he saw convenient. One of these arms was to hold the minute objects, and the other to apply the microscope.

The lenses of Swammerdam's microscopes were of various sizes as well as foci: but all of them the best that could be procured, both for the transparency of the glass and the fineness of the workmanship. His observations were always begun with the smallest magnifiers, from which he proceeded to the greatest; but in the use of them, he was so exceedingly dextrous, that he made every observation subservient to that which succeeded it, and all of them to the confirmation of each other, and to the completing of the description. His chief art seems to have been in constructing scissars of an exquisite fineness, and making them very sharp. Thus he was enabled to cut very minute objects to much more advantage than could be done by knives and lancets; for these, though ever so sharp and fine, are apt to disorder delicate substances by displacing some of the filaments, and drawing them after them as they pass through the bodies; but the scissars cut them all equally. The knives, lancets, and styles he made use of in his dissections, were so fine that he could not see to sharpen them without the assistance of a magnifying glass; but with these he could dissect the intestines of bees with the same accuracy that the best anatomists can do those of large animals. He made use also of very small glass tubes no thicker than a bristle, and drawn to a very fine point at one end, but thicker at the other. These were for the purpose of blowing up, and thus rendering visible the smallest vessels which could be discovered by the microscope; to trace their courses and communications, or sometimes to inject them with coloured liquors.

Swammerdam sometimes made use of spirit of wine, water, or oil of turpentine, for suffocating the insects he wished to examine; and would preserve them for a time in these liquids. Thus he kept the parts from putrefying, and gave them besides such additional strength and firmness, as rendered the dissections much more easy than they would otherwise have been. Having then divided the body transversely with the scissars, and made what observations he could without farther dissection, he proceeded to extract the intestines carefully with very fine instruments, to wash away the fat in the like careful manner; and thus to put the parts into such a state as would best expose them to view; but these operations are best performed while the insects are in their nympha state.

Sometimes the delicate viscera of the insects, after having been suffocated as abovementioned, were put into water; after which, having shaken them gently, he procured an opportunity of examining them, especially the air vessels, which last he could thus separate entire from all the other parts, to the admiration of all who beheld them; as these vessels cannot be distinctly seen in any other manner, or indeed in any way whatever, without injuring them. Frequently also he injected water with a syringe to cleanse the parts thoroughly, after which he blew them up with air and dried them; thus rendering them durable, and fit for examination at a proper opportunity. Sometimes he made very important discoveries, by examining insects which he had preserved for several years in balsam. Other insects he punctured with a very fine needle; and after squeezing out all their moisture through the holes made in this manner, he filled them with air, by means of very slender glass tubes; then dried them in the shade; and lastly anointed them with oil of spike in which a little rosin had been dissolved; and by which means they, for a long time, retained their proper forms. He was likewise in possession of a singular secret, by which he could preserve the limbs of insects as limber and perspicuous as ever they had been. He used to make a small puncture or incision in the tails of worms; and after having with great caution squeezed out all the humours, as well as great part of the viscera, he injected them with wax in such a manner as to give them the appearance of living creatures in perfect health. He found that the fat of all insects was entirely dissolvable in oil of turpentine; by which means he was enabled plainly to discern the viscera; though, after this dissolution, it was necessary to cleanse and wash them frequently in clean water. In this manner he would frequently have spent whole days in the preparation of a single caterpillar, and cleansing it from its fat, in order to discover the true situation of the insect's heart. He had a singular dexterity in stripping off the skins of caterpillars that were on the point of spinning their cones. This was done by letting them drop by their threads into scalding water, and then suddenly withdrawing them. Thus the epidermis peeled off very easily; and, when this was done, he put them into distilled vinegar and spirit of wine mixed together in equal proportions; which, by giving a due degree of firmness to the parts, gave him an opportunity of separating them with very little trouble from the exuviæ, without any danger to the internal parts. Thus the nymph could be shown to be wrapped up in the caterpillar and the butterfly in the nymph; and there is little doubt that those who look into the works of Swmammerdam, will be amply recompensed, whether they consider the unexampled labour or the piety of the author.

M. Lyonet, a late eminent naturalist, usually drowned the insects he designed to examine; by which means he was enabled to preserve both the softness and transparency of the parts. According to him, the insect, if very small, *viz.* one tenth of an inch, or little more, in length, should be dissected on a glass somewhat concave. If it should be suspected that the insect will putrefy by keeping for a few days, spirit of wine diluted with water must be substituted instead of pure water. The insect must be suffered to dry; after which it may be

be fastened by a piece of soft wax, and again covered with water.—Larger objects should be placed in a trough of thin wood; and for this purpose the bottom of a common chip box will answer very well; only surrounding the edge of it with soft wax, to keep in the water or other fluid employed in preserving the insect. The body is then to be opened; and if the parts are soft like those of a caterpillar, they should be turned back, and fixed to the trough by small pins, which ought to be set by a small pair of nippers. At the same time the skin being stretched by another pair of finer forceps, the insect must be put into the water, and dissected therein, occasionally covering it with spirit of wine. Thus the subject will be preserved in perfection, so that its parts may be gradually unfolded, no other change being perceived than that the soft elastic parts become stiff and opaque, while some others lose their colour.

The following instruments were made use of by M. Lyonet in his dissection of the *Chenille de Saul*. A pair of scissars as small as could be made, with long and fine arms: A pair of forceps, with their ends so nicely adjusted, that they could easily lay hold of a spider's thread, or a grain of sand: Two fine steel needles fixed in wooden handles, about two inches and three quarters in length; which were the most generally useful instruments he employed.

Dr. Hooke, who likewise made many microscopic observations, takes notice, that the common ant or pismire is much more troublesome to draw than other insects, as it is extremely difficult to get the body in a quiet natural posture. If its feet be fettered with wax or glue, while the animal remains alive, it so twists its body, that there is no possibility of gaining a proper view of it; and if it be killed before any observation is made, the shape is often spoiled before it can be examined. The bodies of many minute insects, when their life is destroyed instantly shrivel up; and this is observable even in plants as well as insects, the surface of these small bodies being affected by the least change of air; which is particularly the case with the ant. If this creature, however, be dropped into rectified spirit of wine, it will instantly be killed; and when it is taken out, the spirit of wine evaporates, leaving the animal dry, and in its natural posture, or at least in such a state that it may easily be placed in whatever posture we please.

Parts of insects. The *wings*, in many insects, are so transparent, that they require no previous preparation; but some of those that are folded up under *elytra* or cases, require a considerable share of dexterity to unfold them; for these wings are naturally endowed with such a spring, that they immediately fold themselves again, unless care be taken to prevent them. The wing of the earwig, when expanded, is of a tolerable size, yet is folded up under a case not one eighth part of its bulk; and the texture of this wing renders it difficult to be unfolded. This is done with the least trouble immediately after the insect is killed. Holding then the creature by the thorax, between the finger and thumb, with a blunt-pointed pin endeavour gently to open it, by spreading it over the fore-finger, and at the same time gradually sliding the thumb over it. When the wing is sufficiently expanded, separate it from the insect by a sharp knife or a pair of scissars. The wing should be pressed for some time between the thumb and finger before it be removed; it should then be placed between two pieces of paper, and again pressed for at least an hour; after which time, as there will be no danger of its folding up any more, it may be put between the talcs, and applied to the microscope. Similar care is requisite in displaying the wings of the notonecta and other water-insects, as well as most kinds of grylli.

The minute *scales* or *feathers*, which cover the wings of moths or butterflies, afford very beautiful objects for the microscope. Those from one part of the wing frequently differ in shape from such as are taken from other parts; and near the thorax, shoulder, and on the fringes of the wings, we generally meet with hair instead of scales. The whole may be brushed off the wing, upon a piece of paper, by means of a camel's-hair pencil; after which the hairs can be separated with the assistance of a common magnifying glass.

It is likewise a matter of considerable difficulty to dissect properly the *proboscis* of insects, such as the gnat, tabanus, &c. and the experiment must be repeated a great number of times before the structure and situation of the parts can be thoroughly investigated, as the observer will frequently discover in one what he could not in another. The *collector of the bee* which forms a very curious object, ought to be first carefully washed in spirit of turpentine; by which means it will be freed from the unctuous matter adhering to it: when dry, it is again to be washed with a camel's hair-pencil to disengage and bring forward the small hairs which form part of this microscopic beauty. The best method of managing the *stings* of insects, which are in danger of being broken by reason of their hardness, is to soak the case and the rest of the apparatus for some time in spirit of wine or turpentine; then lay them on a piece of paper, and with a blunt knife draw out the sting, holding the sheath with the nail of the finger or any blunt instrument; but great care is necessary to preserve the *feelers* which when cleaned add much to the beauty of the object. The *beard* of the lepas antifera is to be soaked in clean soft water frequently brushing it while wet with a camel's-hair pencil: after it is dried, the brushing must be repeated with a dry pencil to disengage and separate the hairs which are apt to adhere together.

To view to advantage the *fat*, *brains*, and other similar substances, Dr Hooke advises to render the surface smooth, by pressing it between two plates of thin glass, by which means the matter will be rendered much thinner and more transparent; without this precaution, it appears confused by reason of the parts lying too thick upon one another. For *muscular fibres* take a piece of the flesh, thin and dry; moisten it with warm water, and after this is evaporated the vessels will appear more plain and distinct; and by repeated macerations they appear still more so. The *exuviæ* of insects afford a pleasing object, and require but little preparation. If bent or curled up, they will become so relaxed by being kept a few hours in a moist atmosphere, that you may easily extend them to their natural positions; or the steam of warm water will answer the purpose very well.

The *eyes* of insects in general form very curious and

Microscope and beautiful objects. Those of the libellula and other flies, as well as of the lobster, &c. must first be cleaned from the blood, &c. after which they should be soaked in water for some days: one or two skins are then to be separated from the eye, which would be otherwise too opaque and confused; but some care is requisite in this operation; for if the skin be rendered too thin, it is impossible to form a proper idea of the organization of the part. In some substances, however, the organization is such, that by altering the texture of the part, we destroy the objects which we wish to observe. Of this sort are the nerves, tendons, muscular fibres, many of which are viewed to most advantage when floating in some transparent fluid. Thus very few of the muscular fibres can be discovered when we attempt to view them in the open air, though great numbers may be seen if they be placed in water or oil. By viewing the thread of a ligament in this manner, we find it composed of a vast number of smooth round threads lying close together. Elastic objects should be pulled or stretched out while they are under the microscope, that the texture and nature of those parts, the figure of which is altered by being thus pulled out, may be more fully discovered.

Other objects. To examine *bones* by the microscope, they should first be viewed as opaque objects; but afterwards, by procuring thin slices of them, they may be viewed as transparent. The sections should be cut in all directions, and be well washed and cleaned; and in some cases maceration will be useful, or the bones may be heated red hot in a clear fire, and then taken out; by which means the bony cells will appear more conspicuous. The *pores of the skin* may be examined by cutting off a thin slice off the upper skin with a razor, and then a second from the same place; applying the latter to the microscope. The lizard, guana, &c. have two skins, one very transparent, the other thicker and more opaque; and, separating these two, you obtain very beautiful objects.

To view the *scales of fish* to advantage, they ought to be soaked in water for a few days, and then carefully rubbed to clean them from the skin and dirt which may adhere to them. The scales of the eel are a great curiosity; and the more so, as this creature was not known to have any scales till they were discovered by the microscope. The method of discovering them is this. Take a piece of the skin of an eel from off its side, and spread it while moist on a piece of glass, that it may dry very smooth: when thus dried, the surface will appear all over dimpled or pitted by the scales, which lie under a sort of cuticle or thin skin; which may be raised with the sharp point of a penknife, together with the scales, which will then easily slip out; and thus we may procure as many as we please.

The *leaves* of many *trees*, as well as of some plants, when dissected, form a very agreeable object. In order to dissect them, take a few of the most perfect leaves you can find, and place them in a pan with clean water. Let them remain there three weeks, or a month, without changing the water; then take them up; and if they feel very soft, and almost rotten, they are sufficiently soaked. They must then be laid on a flat board, and holding them by the stalk, draw the edge of a knife over the upper side of the leaf, which will take off most of the skin. Then turn the leaf, and do the same with the under side; and when the skin is taken off on both sides, wash out the pulpy matter, and the fibres will be exhibited in a very beautiful manner. The leaf may be slit into two parts, by splitting the stalk; and the skins peeled from the fibres will also make a good object. This operation is best performed in the autumn: the fibres of the leaves are much stronger at that season, and less liable to be broken.—The internal structure of shells may be observed by grinding them down on a hone; and all ores and minerals should be carefully washed and brushed with a small brush to remove any sordes that may adhere to them.

To view the *circulation of the blood*, we must observe living animals of the most transparent kind.—A small eel is sometimes used for this purpose; in which case it must be cleansed from the slime naturally adhering to it; after which it may be put into a tube filled with water, where it can be viewed in a satisfactory manner. The tail of any other small fish may be viewed in the same manner, or put upon a slip of flat glass, and thus laid before the microscope. By filling the tube with water when an eel is made use of, we prevent in a great measure the sliminess of the animal from soiling the glass.

The particles of the blood form a very curious object, and have been carefully viewed by different philosophers; who, nevertheless, differ from one another very much in their accounts of them. The best method of viewing these is to take a small drop of blood when warm, and spread it as thin as possible upon a flat piece of glass. By diluting it a little with warm water, some of the large globules will be separated from the smaller, and many of them subdivided; or a small drop of blood may be put into a capillary glass-tube, and then placed before the microscope. Mr Baker advises warm milk as proper to be mixed with the blood; but Mr Hewson, who is accounted the most accurate observer, diluted the blood with that fluid which undoubtedly is more natural to it, *viz.* its own serum: by this method he could preserve the small particles entire, and view them distinctly; and thus he found that they were not globular, as had been imagined by other anatomists, but flat. Having shaken a piece of the crassamentum of the blood in serum till the latter became a little coloured, he spread it with a softhair pencil on a piece of thin glass, which he placed under the microscope, in such a manner as not be quite horizontal, but rather higher at one end than the other. Thus the serum flows from the higher to the lower part; and, as it flows, some of the particles will be found to swim on their flat sides, and will appear to have a dark spot in the middle; while others will turn over from one side to the other as they roll down the glass. Many cruel experiments have been tried in order to observe the circulation of the blood in living creatures, and an apparatus has been invented for viewing the circulation in the mesentery of a frog; but as this can answer no useful purpose, and will never be put in practice by persons of humanity, we forbear to mention it.

II. Besides the objects for the microscope already mentioned, there are innumerable others, some hardly visible, and others totally invisible, to the naked eye; and which therefore, in a more particular sense, are denominated.

Microscopic animals. They are the animalcules or moving bodies in water, in which certain substances have been infused; and of which there are a great many different kinds. These animalcula are sometimes found in water which we would call *pure*, did not the microscopes discover its minute inhabitants; but not equally in all kinds of water, or even in all parts of the same kind of it. The surfaces of infusions are generally covered with a scum which is easily broken, but acquires thickness by standing. In this scum the greatest number of animalcules are usually found. Sometimes it is necessary to dilute the infusions; but this ought always to be done with water, not only distilled, but viewed through a microscope, lest it should also have animalcules in it, and thus prove a source of deception. It is, however, most proper to observe those minute objects after the water is a little evaporated; the attention being less diverted by a few objects than when they appear in great numbers. One or two of the animalcules may be separated from the rest by placing a small drop of water on the glass near that of the infusion; join them together by making a small connection between them with a pin; and as soon as you perceive that an animalcule has entered the clear drop, cut off the connection again.

Eels in paste are obtained by boiling a little flour and water into the consistence of book-binders paste; then exposing it to the air in an open vessel, and beating it frequently together to keep the surface from growing mouldy or hard. In a few days it will be found peopled with myriads of little animals visible to the naked eye, which are the eels in question. They may be preserved for a whole year by keeping the paste moistened with water; and while this is done, the motion of the animals will keep the surface from growing mouldy. Mr Baker directs a drop or two of vinegar to be put into the paste now and then. When they are applied to the microscope, the paste must be diluted in a piece of water for them to swim in.

Numberless animalcules are observed by the microscope in infusions of pepper. To make an infusion for this purpose, bruise as much common black pepper as will cover the bottom of an open jar, and lay it thereon about half an inch thick: pour as much soft water into the vessel as will rise about an inch above the pepper. Shake the whole well together: after which they must not be stirred, but be left exposed to the air for a few days; in which time a thin pellicle will be formed on the surface, in which innumerable animals are to be observed by the microscope.

The microscopic animals are so different from those of the larger kinds, that scarce any sort of analogy seems to exist between them; and one would almost be tempted to think that they lived in consequence of laws directly opposite to those which preserve ourselves and other visible animals in existence. They have been systematically arranged by O. F. Muller; though it is by no means probable that all the different classes have yet been discovered. Such as have been observed, however, are by this author divided in the following manner.

I. *Such as have no external organs.*

1. Monas: Punctiforma. A mere point.
2. Proteus: Mutabilis. Mutable.
3. Volvox: Sphæricum. Spherical.
4. Enchelis: Cylindracea. Cylindrical.
5. Vibrio: Elongatum. Long.

* Membranaceous.

6. Cyclidium: Ovale. Oval.
7. Paramecium: Oblongum. Oblong.
8. Kolpoda: Sinuatum. Sinuous.
8. Gonium: Angulatum. With angles.
10. Bursaria. Hollow like a purse.

II. *Those that have external organs.*

* Naked, or not inclosed in a shell.

1. Cercaria: Caudatum. With a tail.
2. Trichoda: Crinitum. Hairy.
3. Kerona: Corniculatum. With horns.
4. Himantopus: Cirratum. Cirrated.
5. Leucophra: Ciliatum undique. Every part ciliated.
6. Vorticella: Ciliatum apice. The apex ciliated.

* Covered with a shell.

7. Branchionus: Ciliatum apice The apex ciliated

I. *Monas.*

This is by our author defined to be "an invisible (to the naked eye), pellucid, simple, punctiform worm;" but of which, small as it is, there are several species.

1. The *monas termo* or *gelatinosa*, is a small jelly-like point, which can be but imperfectly seen by the single microscope, and not at all by the compound one. In a full light they totally disappear, by reason of their transparency. Some infusions are so full of them that scarce the least empty space can be perceived; the water itself appearing composed of innumerable globular points, in which a motion may be perceived somewhat similar to that which is observed when the sun's rays shine on the water; the whole multitude of animals appearing in commotion like a hive of bees. This animal is very common in ditch-water, and in almost all infusions either of animal or vegetable substances.

2. *Monas atomus* or *albida;* white monas with a variable point. This appears like a white point, which thro' a high magnifier appears somewhat egg-shaped. The smaller end is generally marked with a black point, the situation of which is variable; sometimes it appears on the large end, and sometimes there are two black spots in the middle. This species was found in sea water, which had been kept through the whole winter, but was not very fetid. No other kind of animalcule was found in it.

3. *Monas punctum* or *nigra*, black monas. This was found in a fetid infusion of pears, and appears in form of a very minute, opaque, and black point, moving with a slow and wavering motion.

4. *Monas ocellus*, transparent like talc, with a point in the middle. This is found in ditches covered with conferva,

ferva, and sometimes with the cyclidium milium; the margin of it is black, with a black point in the middle.

5. *Monas lens* or *hyalina*; of a talcy appearance. This is found in all kinds of water: sometimes even in that which is pure, but always in the summer-time in ditch-water. It is found also in all infusions of animal or vegetable substances, whether in fresh or salt water; myriads being contained in a single drop. It is found likewise in the filth of the teeth. It is nearly of a round figure; and so transparent, that it is impossible to discover the least vestige of intestines. They generally appear in clusters, but sometimes singly. Contrary to what happens to other animalcules, they appear to cover the edges of the drop when evaporating, and where they instantly die. A few dark shades, probably occasioned by the wrinkling of the body, are perceived when the water is nearly evaporated. The motions of this animalcule are generally very quick; and two united together, may sometimes be seen swimming among the rest; which is thought to be a single one generating another by division, as is related under the article AIMALCULE. These and the animalcules of the first species are so numerous, that they exceed all calculation even in a very small space.

6. *Monas mica*, marked with a circle. This is found in the purest waters, and may be discovered with the third lens of the single microscope when the magnifying power is increased. It appears like a small lucid point; but can assume an oval or spherical shape at pleasure: sometimes the appearance of two kidneys may be perceived in its body, and there is commonly the figure of an ellipse in it; the situation of which is moveable, sometimes appearing in the middle and sometimes approaching to either extremity. It seems encompassed with a beautiful halo, which is thought to be occasioned by the vibration of fine invisible hairs. It has a variety of motions, and often turns round for a long time in the same place.

7. The *tranquilla*, or egg-shaped transparent monas with a black margin, is found in urine which has been kept for some time. Urine in this state acquires a scum in which the animalcules reside; but though kept for several months, no other species was found in it. A drop of urine is usually fatal to other animalcules, though this species is to be met with in no other substance. It is generally fixed to one point, but has a kind of vacillatory motion. Frequently these creatures are surrounded with a halo. Sometimes they are quadrangular, and at other times spherical; the black margin is not always to be found; and sometimes there is even an appearance of a tail.

8. The *lamellula*, or flat transparent monas, is most usually found in salt-water; is of a whitish colour and transparent, more than twice as long as it is broad, with a dark margin, having a vacillatory motion, and frequently appearing as double.

9. The *pulvisculus* or *monas* with a green margin. These are generally found in marshy grounds in the month of March. They appear like small spherical grains of a green colour on the circumference, having sometimes a green bent line passing through the middle. They appear sometimes in clusters, from three to seven or more in number, having a wavering kind of motion.

10. The *uva*, or transparent gregarious mona, is found in a variety of infusions, and is of that kind which multiplies by dividing itself. They appear in clusters of four, five, or sometimes many more; the corpuscles being of various sizes, according to the number collected into one group. The smaller particles, when separated from the larger, move about with incredible swiftness. A single corpuscle separated from the heap, and put by itself into a glass, soon increased in size till it nearly attained the bulk of the parent group. The surface then assumed a wrinkled appearance, and gradually became like the former, separating again into small particles, which likewise increased in bulk as before.

II. *The proteus.*

An invisible, very simple, pellucid worm, of a variable form.

1. The *diffluens*, branching itself out in a variety of directions. It is very rare, and only met with in fens; appearing like a grey mucous mass, filled with a number of black globules, and continually changing its figure, pushing out branches of different lengths and breadths. The internal globules divide immediately, and pass into the new formed parts; always following the various changes of the animalcule; which changes seem to proceed entirely from the internal mechanism of its body, without the aid of any external power.

2. The *tenax*, running out into a fine point. This is a pellucid gelatinous body, stored with black molecules, and likewise changing its figure, but in a more regular order than the former. It first extends itself in a straight line, the lower part terminating in a bright acute point. It appears to have no intestines; and when the globules are all collected in the upper part, it next draws the pointed end up toward the middle of the body, which assumes a round form. It goes through a number of different shapes, part of which are described under the article ANIMALCULE. It is found in some kinds of river-water, and appears confined almost entirely to one place, only bending sidewise.

III. *Volvox.*

An invisible, very simple, pellucid, spherical worm.

1. The *punctum*; of a black colour, with a lucid point. This is a small globule, with one hemisphere opaque and black, the other having a crystalline appearance; and a vehement motion is observed in the black part. It moves as on an axis, frequently passing through the drop in this manner. Many are often seen joined together in their passage through the water; sometimes moving as in a little whirlpool, and then separating. They are found in great numbers on the surface of fetid sea-water.

2. The *granulum* is of a spherical figure and green colour, the circumference being bright and transparent. It is found in marshy places about the month of June, and moves but slowly. It seems to have a green opaque nucleus.

3. The *globulus*, with the hinder part somewhat obscure, sometimes verges a little towards the oval in its shape, having a slow fluttering kind of motion, but more

more quick when diſturbed. The inteſtines are but juſt viſible. It is found in moſt vegetable infuſions, and is ten times larger than the mona lens.

4. The *pilula*, ſmall and round, with green inteſtines. This is found in water where the lemna minor grows, in the month of December, and has a kind of rotatory motion, ſometimes ſlow and at others quick. The inteſtines are placed near the middle, apparently edged with yellow. There is a ſmall inciſion on one of the edges of the ſphere, which may poſſibly be the mouth of the creature. The whole animal appears encompaſſed with a halo.

5. The *grandinella*, with immoveable inteſtines, is much ſmaller than the laſt, and marked with ſeveral circular lines. The inteſtines are immoveable, and no motion is perceived among the interior molecules. Sometimes it moves about in a ſtraight line, at others irregularly, and ſometimes keeps in the ſame ſpot, with a tremulous motion.

6. The *ſocialis*, with cryſtalline molecules placed at equal diſtances from one another. This is found in water where the chara vulgaris has been kept; and has its molecules diſpoſed in a ſphere, filling up the whole body of the animalcule; but whether they be covered by a common membrane or united by a ſtalk (as in the *vorticella ſocialis* to be afterwards deſcribed) is not known. When very much magnified, ſome black points may be ſeen in the cryſtalline molecules. Its motion is ſometimes rotatory and ſometimes not.

7. The *ſphericula*, with round molecules, appears to conſiſt of pellucid homogeneous points of different ſizes. It moves ſlowly from right to left and back again, about a quarter of a circle each time.

8. The *lunula*, with lunular molecules, is a ſmall roundiſh tranſparent body, conſiſting of an innumerable multitude of homogeneous molecules of the ſhape of a creſcent, without any common margin. It moves continually in a twofold manner, *viz.* of the molecules among one another, and the whole maſs turning ſlowly round. It is found in marſhy places in the beginning of ſpring.

9. The *globator*, or ſpherical membranaceous volvox is found in great numbers in the infuſions of hemp and tremella, and in ſtagnant waters in ſpring and ſummer it was firſt obſerved and depicted by Leewenhoeck, but the deſcriptions of it given by authors differ conſiderably from each other. The following is that of Mr Baker. "There is no appearance of either head tail or fins. It moves in every direction, backwards, forwards, up or down, rolling over and over like a bowl, ſpinning horizontally like a top, or gliding along ſmoothly without turning itſelf at all; ſome times its motions are very ſlow, at other times very ſwift and when it pleaſes it can turn round as upon an axis very nimbly, without moving out of its place. The body is tranſparent, except where the circular ſpots are placed, which are probably its young. The ſurface of the body in ſome is as if all dotted over with little points, and in others as if granulated like ſhagreen. In general it appears as if ſet round with ſhort moveable hairs." Another author informs us that "they are at firſt very ſmall, but grow ſo large that they can be diſcerned with the naked eye: they are of a yellowiſh green colour, globular figure, and in ſubſtance membranaceous and tranſparent; and in the midſt of this ſubſtance ſeveral ſmall globes may be perceived. Each of theſe are ſmaller animalcula, which have alſo the diaphanous membrane, and contain within themſelves ſtill ſmaller generations, which may be diſtinguiſhed by means of very powerful glaſſes. The larger globules may be ſeen to eſcape from the parent, and then increaſe in ſize."

This little animal appears like a tranſparent globule of a greeniſh colour, the fœtus being compoſed of ſmaller greeniſh globules. In proportion to its age it becomes whiter and brighter, and moves ſlowly round its axis; but to the microſcope its ſurface appears as if granulated, the roundeſt molecules fixed in the centre being largeſt in thoſe that are young. The exterior molecules may be wiped off, leaving the membrane naked. When the young ones are of a proper ſize, the membrane opens, and they paſs through the fiſſure; after which the mother melts away. Sometimes they change their ſpherical figure, and become flat in ſeveral places. They contain from 8 to between 30 and 40 globules within the membrane.

10. The *morum*, with ſpherical green globules in the centre. This is found amongſt the lemna in the months of October and December, and has a ſlow rotatory motion. The globules ſeldom move, though a ſlow quivering motion may ſometimes be perceived among them in the centre.

11. The *alva*, compoſed of green globules not incloſed in any membrane, is found in the month of Auguſt in water where the lemma polyrrhiza grows. —It conſiſts of a congeries of greeniſh-coloured globules, apparently of an equal ſize, with a bright ſpot in the middle; the whole maſs is ſometimes of a ſpherical form, ſometimes oval, without any common membrane: a kind of halo may be perceived round it, and the maſs generally moves from right to left, but ſcarce any motion can be perceived among the globules themſelves. Theſe maſſes contain from four to fifty globules, of which a ſolitary one may ſometimes be ſeen. Sometimes alſo two maſſes of globules have been perceived joined together.

12. The *vegetans*, terminating in a little bunch of globules. This is found in river-water in the month of November. It conſiſts of a number of floccoſe opaque branches inviſible to the naked eye; and at the apex of theſe is a ſmall congeries of very minute oval pellucid corpuſcles. Muller, who diſcovered this ſuppoſed it at firſt to be a ſpecies of microſcopic and river ſertularia: but he afterwards found the bunches quitting the branches, and ſwimming about in the water with a proper ſpontaneous motion; many of the old branches being deſerted, and the younger ones furniſhed with them.

IV. *Enchelis*:

A ſimple, inviſible, cylindric worm.

1. The *viridis*, or green enchelis has an obtuſe tail, the forepart terminating in an acute truncated angle; the inteſtines are obſcure and indiſtinct. It continually varies its motion, turning from right to left.

2. The *punctifera*, having the fore part obtuſe, the hinder part pointed. It is opaque, and of a green colour, with a ſmall pellucid ſpot in the fore part, in which two black points may be ſeen; and a kind of double

double band crosses the middle of the body. The hinder part is pellucid and pointed, with an incision supposed to be the mouth, at the apex of the fore-part. It is found in marshes.

3. The *deses*, or gelatinous enchelis, is found, though rarely, in an infusion of lemnæ, and moves very slowly. The body is round, of a very dark-green, the fore-part bluntly rounded off, and the hinder part somewhat tapering, but finished with a round end: near the extremities there is a degree of transparency.

4. The *similis*, with moveable intestines, is found in water that has been kept for several months: it is of an egg-shape, and generally moves very quick either to the right or left. It is supposed to be furnished with hairs, because when moving quickly the margin appears striated. The body is opaque with a pellucid margin, and filled with moveable spherules.

5. The *serotina*, with immovable intestines, is of an oval figure, partly cylindrical, the fore-part smaller than the hind, with a black margin, full of gray vesicular molecules: it moves very slowly.

6. The *nebulosa*, with visible moveable intestines, is found in the same water with the cyclidium glaucoma but is much more scarce. The body is egg-shaped, the fore-part narrow, and frequently filled with opaque confused intestines: when moving, it elevates the fore-part of the body. It is about three times as large as the cyclidium glaucoma.

7. The *seminulum* is found in water that has been kept for some days, and moves by ascending and descending alternately. It is of a cylindrical figure, twice as long as broad, the intestines in the fore-part transparent, but opaque in the hinder part. Sometimes it is observed swimming about with the extremities joined together.

8. The *intermedia*, with a blackish margin, is one of the smallest animalcules: it has a transparent body, without any visible intestines. The fore and hind parts are of an equal size, and the edge is a deeper colour than the rest. Some have a point of the middle, others a line passing through it.

9. The *ovulum*, is transparent, round, and egg-shaped. A very strong magnifier discovers some long foldings on the surface, with a few bright molecules here and there.

10. The *pirum*, with the hinder part transparent, has the fore part portuberant and filled with molecules. The hinder part is smaller and empty, with moveable molecular intestines. Its motion is rapid, passing backwards and forwards through the diameter of the drop When at rest, it appears to have a little swelling on the middle of the body.

11. The *tremula* was found in an infusion with the paramæcia aurelia, and many other animalcules. It is among the least of these minute creatures, and is of a cylindrical figure and gelatinous texture. Its extremity appears pointed, and has a tremulous motion, so as to induce a suspicion that the creature has a tail. Two of these creatures may at times be seen to adhere together.

12. The *constricta*, with a stricture in the middle is found in salt-water, and is of a very small size, having the middle drawn in as if tied with a string. It is of an oval shape.

13. The *elliptica*, with a congeries of green intestines, is found among the green matter on the sides of vessels in which water has been kept for some time. It is of a roundish shape, and transparent; the fore-part obtuse, the hinder part rather sharp, and marked with green spots. They are generated in such numbers, that myriads may sometimes be found in one drop.

14. The *fusus*, with both ends truncated, was found in water called pure, and had a languid motion. The body is round and transparent, with the fore and hind parts somewhat smaller than the rest. In the inside is a long and somewhat winding intestine, with a bright sky-coloured fluid, and some black molecules transversely situated.

15. The *fritillus*, with the fore-part truncated, is found in an infusion of grass and hay, and runs backward and forward through the drop with a wavering motion. It is one of the most transparent animalcules, and has the fore-part obtusely convex.

16. The *caudata*, with a kind of tail, is but seldom met with. The body is grey and transparent, with globular molecules divided from each other, and dispersed thro' the whole; the fore-part is thick and obtuse, the hind part crystalline and small, the end truncated.

17. The *epistomium*, with the fore-part slender and roundish, is among the smaller animalcula; the body cylindrical and bright, the hind part obtuse, the fore-part smaller, and terminating in a globule, with now and then a black line down the middle.

18. The *gemmata* is found in ditch-water where the lemna thrives. It has a cylindrical body, the upper part running out into a transparent neck, with a double series of globules running down the body. It moves slowly and generally in a straight line.

19. The *retrograda* moves commonly sideways, and sometimes in a retrograde manner. It has a gelatinous transparent body, thicker in the middle than at the ends, without any thing that can be called intestines except a pellucid globule discoverable near the hinder part.

20. The *festinans*, with obtuse ends, is found in sea-water, and has a quick vacillatory motion from one side to the other. The body is round, with the fore-part transparent. More than half the length of it is without any visible intestines; but the lower end is filled with minute vesicular and transparent globules; a large globular vesicle is observed in the fore part.

21. The *farcimen* was found by Joblot in an infusion of blue bottles moving very slowly in an undulatory manner. The body is cylindrical, about four times as long as broad, truncated at both ends, the intestines opaque, and not to be distinguished from one another. It forms itself into the shape of the letter *S*, by turning the two extremities contrariwise.

22. The *index* is found in water with the lemna minor; the body opaque, of a grey colour, and long conical shape; the lower end is obtuse, one side projecting like a finger from the edge, with two very small projections from the lower end. It has the power of retracting these projections, and making both ends appear obtuse.

23. The *truncus*, with a kind of head, is the largest of this kind of animalcules. The body is grey, long, and mucous; the fore-part globular, the hinder part obtuse; but it can alter its shape considerably. Sometimes there is an appearance of three teeth proceeding from

Microscope

from one of the sides. Globules of different sizes may be observed within the body. The creature rolls slowly about from right to left.

24. The *larva* is long, round and filled with molecules. The fore-part is obtuse and transparent, with a kind of neck or small contraction formed near this end: the lower end is pointed; and about the middle of the body are two small pointed projections like nipples, one on each side.

25. The *spatula*, with the fore-part transparent, and of the shape of a spatula. It is perfectly cylindrical, crystalline, and marked with fine longitudinal furrows; having generally two transparent globules, one below the middle, the other near the extremity. It moves in a wavering kind of manner, retaining its general form, but moving the spatula in various ways. Muller informs us, that he saw it once draw the spatula within the body, and keep it there for two hours.

26. The *pupula*, with the fore-part papillary, is found in dunghill water in November and December: it has a rotatory motion on a longitudinal axis, and moves in an oblique direction through the water. Both ends are obtuse; and the hinder part is marked with a transparent circle, or circular aperture.

27. The *pupa*, with a small nipple proceeding from the apex, has a very slow motion, and resembles the former, only that it wants the transparent circle, and is much larger. It is all opaque but the fore-end and filled with obscure points.

V. *Vibrio*:

A very simple, invisible, round, and rather long worm.

1. The *lineola* is found in most vegetable infusions in such numbers, that it seems to fill up almost the whole of their substance. It is so small, that with the best magnifiers we can discern little more than an obscure tremulous motion among them. It is more slender than the monas terma.

2. The *rugola* is like a bent line; and sometimes draws itself up in an undulated shape, at others moves without bending the body at all.

3. The *bacillus*, equally truncated at both ends, is found in an infusion of hay; but Muller mentions the following remarkable fact, *viz.* that having made two infusions of hay in the same water he put the hay whole in the one, but cut it in pieces in the other: he found in the former none of the vibrio bacillus, but many of the monas, lens and kolpoda cucullus; in the latter were many of the vibrio, but few of the other.—This is from six to ten times longer than the monas lens, but much more slender.

4. The *undula*, is a round, gelatinous, little, undulating line. This is the animal which Leewenhoeck says is less than the tail of one of the seminal animalcules. It never appears straight; but when at rest it resembles the letter V, and when in motion the letter M. It commonly rests on the top of the water; sometimes it fixes itself by one extremity, and whirls round.

5. The *serpens*, with obtuse windings or flexures, is found in river-water, but seldom. It is slender, and gelatinous, resembling a serpentine line, with an intestine down the middle.

6. The *spirillum* is exceedingly minute, and twisted in the form of a spiral, which seems to be its natural shape, as it never untwists itself, but moves forward in a straight line, vibrating the hind and fore-parts. It was found in 1782 in an infusion of the sonchus arvensis.

7. The *vermiculus* has a milky appearance, with an obtuse apex, and a languid undulatory motion, like that of the common worm. It is found in marshy water in November, but seldom. It is thought to be the animal mentioned by Leewenhoeck as found in the dung of the frog and spawn of the male libellula.

8. The *intestinum*, is found in marshy waters, and has a slow progressive motion. It is milk-coloured, with two obtuse ends, and four or five spherical eggs are perceivable at the hinder extremety.

9. The *bipunctatus* is found in fetid salt-water, and moves slowly; for the most part in a straight line. The body is pellucid, and of a talc-like appearance; both ends are truncated, and in the middle one or two pellucid globules placed lengthwise.

10. The *tripunctatus* is also transparent and talcy, with both ends tapering. It has three pellucid globules, the middle one of which is largest, the space between them being generally filled with a green matter. It moves in a straight line, backwards and forwards.

11. The *paxillifer*, or straw-like vibrio, consists of a transparent membrane, with yellow intestines, and two or three visible points. They are found in parcels together from seven to forty in number, and ranged in a variety of forms. When at rest, they generally assume a quadrangular figure; and are thought to have some affinity to the *hair-like animal* described by Mr Baker, and of which an account is given under the article ANIMALCULE, n° 3.

12. The *lunula*, or bow-shaped vibrio, resembles the moon at its first quarter; it is of a green colour, and has from seven to ten globules disposed in a longitudinal direction.

13. The *verminus* is found in great plenty in salt water kept for some days till it becomes fetid. It moves quickly, and with an undulatory motion, backwards and forwards. It has a long transparent membrane, with the hind part broader than the fore one. These animalcula seem to be joined together in a very singular manner.

14. The *mallæus* is found in great plenty in spring-water and is alternately at rest and in motion every moment; in the former case resembling the letter T, and in the latter V. It is a white pellucid animalcule, with a globule affixed to the base.

15. The *acus* in the shape of a sewing needle; the neck round and partly transparent, and marked in the middle with a red point; the tail resembling a fine bristle.

16. The *sagitta*, with a setaceous tail, has a long and flexible body; broadest about the middle, and filled there also with grey molecules; the fore-part being drawn out into a thin and transparent neck, and the upper end thick and black. It is found in salt-water, and seems to move by contracting and extending its neck.

17. The *gordius*, with a tail terminated by a small tubercle, was found in an infusion made with salt water. Its fore part throughout about one sixth of its length is transparent, and furnished with an alimentary tube of a sky colour; the lower part being

ing bright and pointed, and the middle full of small globules.

18. The *serpentulus*, somewhat pointed at both ends. This is found in the infusions of vegetables which have been kept for some weeks. Its body is of a whitish colour, frequently convoluted, and drawn into different figures. The tail is furnished with a long row of very minute points.

19. The *coluber* is found in river-water; the tail is extremely small, and bent so as to form a considerable angle with the body; the mouth, œsophagus, the molecules in the intestines, and the twistings of them, are easily discerned.

20. The *anguillula* is divided into four varieties: 1. The vinegar eel; 2. That in paste; 3. That of fresh water; and, 4. That of salt. The two first are treated of under the article ANIMALCULE; the third is exceedingly transparent, with a few transverse lines upon the body, but without any appearance of intestines. Sometimes it has a long row of little globules, and is frequently furnished with two small oval ones: the tail terminates in a point. It has been found in the sediment formed by vegetables on the sides of vessels in which water had been kept for a long time. The fourth variety appears, when pressed between two glass plates, to be little more than two crystalline skins with a kind of intestines of a clay colour. The younger ones are furnished with pellucid molecules.

21. The *linter*, or ventricose oval vibrio, with a short neck, is found among the *lemnæ*, but not very frequently. It is among the larger kinds of animalcules, egg-shaped, pellucid, inflated, and somewhat depressed at top; having a moveable crystalline neck, and the belly filled with pellucid molecules.

22. The *utriculus* resembles a bottle; the belly is full of molecular intestines, the neck bright and clear the top truncated, and some have a pellucid point at the bottom of the belly. It has a constant and violent vacillatory motion, the neck moving very quickly from side to side.

23. The *fasciola* is found in water just freed from the frost, and not often in any other fluid. It is pellucid, with intestines like points in the middle. There is likewise an alimentary canal gradually diminishing in size. Its motion is very quick.

24. The *colymbus* is larger than many of the other species of vibrio, and resembles a bird in shape. The neck, which is a little bent, is round, shorter than the trunk, of an equal size throughout, and of a bright appearance, with the apex obtuse. The trunk is thick, somewhat triangular, full of yellow molecules; the fore-part broad, the hinder part acute, the motion slow.

25. The *strictus* has a linear body, being a bright membranaceous thread; the hinder part somewhat thicker, round, and filled with molecules, excepting at the end, where there is a small empty pellucid space. It can draw in the slender filiform part at pleasure.

26. The *anas*, with both ends attenuated, and the neck longer than the tail, is found in salt water; tho' a kind is likewise found in fresh water with a neck longer than the other. The trunk of this animalcule is oblong, opaque, and filled with molecules; the fore and hind parts are drawn out into a pellucid talcy membrane, which the creature can retract at pleasure.

27. The *cygnus* is a very pellucid line, crooked at top, swelling in the middle, and sharp at the end; the middle full of dark coloured molecules and pellucid intestines. It is very small, and moves more slowly than any of those that move and advance their necks.

28. The *anser* is found in water where duckweed grows. The trunk is elliptic, round, and without any inequallity on the sides. It it full of molecules: the hind part sharp and bright; the fore part produced into a bending neck, longer than the body; the apex whole and even, with blue canals passing between the marginal edges, occupying the whole length of the neck; and in one of them a violent descent of water to the beginning of the trunk is observable. It moves the body slow, but the neck more briskly.

29. The *olor* is found in water that has been kept for a long time, and is full of vegetable green matter. The body is elliptical and ventricose, the hind part somewhat sharp, and sometimes filled with darkish molecules. The neck is three or four times longer than the body; of an equal size throughout, and is moved very quicky; but the motion of the body itself is slow.

30. The *falx*, with a crooked neck, and obtuse hinder part, is pellucid and elliptical; the fore part lessening into a little, round, bright neck, nearly as long as the trunk. The latter is somewhat gibbous, and filled with very small molecules; and there are two small bright globules, one within the hind extremity, and the other in the middle of the body. The neck of this animalcule is immoveable; whence it moves something like a scythe.

31. The *intermedius* appears to be an intermediate species betwixt the falx and the fasciola. It seems to be a thin membrane constantly folded. The whole has a crystalline talcy appearance; the middle filled with grey particles of different sizes. It has all round a distinct bright margin.

VI. *Cyclidium.*

A simple, invisible, flat, pellucid, orbicular or oval worm.

1. The *bulla*, or orbicular bright cyclidium. This is found occasionally in an infusion of hay. It is very pellucid and white, but the edges somewhat darker than the rest. It moves slowly, and in a semicircular direction.

2. The *millium* is very pellucid, and, splendid like crystal; and of an elliptical figure, with a line through the whole length of it. The motion is swift, interrupted, and fluttering.

3. The *fluitans* is one of the smallest animalcula; the body somewhat of an oval shape, with two small blue spaces at the sides.

4. The *glaucoma* has an oval pellucid body, with both ends plain, or an oval membrane with a distinct well-defined edge. The intestines are so transparent, that they can scarce be discerned when it is empty. When full, they are of a green colour, and there are dark globules discoverable in the middle. When there is plenty of water this animalcule moves swiftly in a circular and diagonal direction; when it moves slowly, it seems to be taking in water, and the intestines are in a violent commotion. It generates by division.

5. The *nigricans* is very small, pellucid, and flat, with a black margin.

6. The *rostratium* is oval, smooth, and very pellucid, with the fore part running out into an obtuse point, with which it seems to feel and examine the bodies to which it comes. The intestines are filled with a blue liquor, the colour of which sometimes vanishes, and then they seem to be composed of vesicles.

7. The *nucleus* resembles a grape seed, the body being pellucid and depressed, the fore part obtusely convex, and the hind part acute.

8. The *hyalinum* has a tremulous kind of motion; the body oval, flat, and bright, without any visible intestines.

9. The *pediculus* is scarce ever seen but on the hydra pallida, upon which it runs as if it had feet. It is gelatinous and white; the bottom gibbous over the back; the extremities depressed and truncated, with one end sometimes apparently cloven into two, which may be supposed the mouth.

10. The *dubium* is of an oval shape, with one side convex the other concave; the margin pellucid, and the inner part containing a great number of molecules.

VII. *Paramæcium.*

An invisible, membranaceous, flat, and pellucid worm.

1. The *aurelia* is membranaceous, pellucid, and four times longer than it is broad; the fore part obtuse and transparent; the hind part filled with molecules. It has somewhat the appearance of a gimlet by reason of a fold which goes from the middle to the apex, and is of a triangular figure. It moves in a rectilinear and vacillatory manner. It is found in ditches where there is plenty of duckweed, and will live many months in the same water without any renewal of the latter.

2. The *chrysalis* is found in salt water, and differs very little from the former, only the ends are more obtuse, and the margins are filled with black globules.

3. The *versutum* is found in ditches, and has an oblong, green, and gelatinous body, filled with molecules; the lower part thicker than the other; and both ends obtuse. It propagates by division.

4. The *oviferum* is membranaceous, oval, grey, and pellucid, with many oval corpuscles dispersed through the body.

5. The *marginatum* is flat, elliptical, and every where filled with molecules, except in the lower end where there is a pellucid vesicle. It is surrounded by a broad double margin, and a bright spiral intestine is observable.

VIII. *Kolpoda.*

An invisible, pellucid, flat, and crooked worm.

1. The *lamella* is very seldom met with. It resembles a long, narrow, and pellucid membrane, with the hind part obtuse, narrower, and curved towards the top. It has a vacillatory and very singular motion; going upon the sharp edge, not on the flat side as is usual with microscopic animals.

2. The *gallinula* is found in fetid salt water; and has the apex somewhat bent, the belly oval, convex, and striated.

3. The *rostrum* is found though seldom, in water where the lemna grows; and has a slow and horizontal motion. The fore part is bent into a kind of hook; the hind part obtuse, and quite filled with black molecules.

4. The *ochrea* is depressed, membranaceous, and flexible; one edge nearly straight; the other somewhat bent, filled with obscure molecules, and a few little bladders dispersed here and there.

5. The *mucronata* is a dilated bright membrane; the apex an obtuse point, with a broad marked border running quite round it. It is filled with grey molecules within the margin, and has a truncated appearance.

6. The *triquetra* was found in salt water, and appears to consist of two membranes; the upper side flattened, the lower convex, with the apex bent into a kind of shoulder.

7. The *striata* is likewise found in salt water, and is very pellucid and white, with the upper part rather bent, and terminating in a point; the lower part obtusely round: there is a little black pellucid vesicle at the apex; and with a very great magnifying power the body appears covered with long streaks.

8. The *nucleus* is of an oval shape, with the vertex pointed, and of a brilliant transparency, by which the viscera are rendered visible. These consist of a number of round diaphanous vesicles.

9. The *meleagris* has a dilated membrane, with very fine folds, which it varies in a moment. The fore part of the body to the middle is clear and bright; the hind part variously folded in transverse and elevated plaits and full of molecules. Beneath the apex are three or four teeth; but in some the edge is obtusely notched, and set with smaller notches. In the hinder part are 12 or more equal pellucid globules.

10. The *assimilis* is found on the sea-coast, and has an elliptic mass in the middle, but is not folded like the former. The margin of the fore part is notched from the top to the middle; the lower part swells out, and contracts again into a small point.

11. The *cucullus* is found in vegetable infusions, and in fetid hay; moving in all directions, and commonly with great vivacity. It is very pellucid, and has a well defined margin, filled with little bright vesicles differing in size, and of no certain number. Its figure is commonly oval, with the top bent into a kind of beak, sometimes oblong, but most commonly obtuse. It has in the inside from 8 to 24 bright little vesicles not discernible in such as are young. Some have supposed these to be animalcules which this creature has swallowed; but Mr Muller is of opinion that they are its offspring. When this creature is near death by reason of the evaporation of the water, it protrudes its offspring with violence. From some circumstances it would seem probable that this animalcule casts its skin, as is the case with some insects.

12. The *cucululus* is found in an infusion of the sonchus arvensis. It is very pellucid and crystalline, with several globules, and has an oblique incision a little below the apex.

13. The *cuculio* is elliptical, flat on the upper side, and convex on the under; the fore part is clear, and from the middle to the hinder part is full of silver-like globules. It frequently stretches out the fore part, and folds it in different positions.

14. The

14. The *ren*, or *crassa*, is found in an infusion of hay, commonly about 13 hours after the infusion is made, and has a quick and vacillatory motion. Its body is yellow, thick, and somewhat opaque; curved a little in the middle, so that it resembles a kidney; and full of molecules. When the water in which it swims is about to fail, it takes an oval form, is compressed, and at last bursts.

15. The *pirum* has an uniform and transparent body, without any sensible inequality; and is of a pale colour, with obscure little globules. It propagates by division.

16. The *cuneus* is white, gelatinous, and without any distinct viscera; having a bright striated pellucid pustule on one side of the fore-part. The apex has three or four teeth; and it can bend the hinder part into a spiral form.

IX. *Gonium*

An invisible, simple, smooth, and angular worm.

1. The *pectorale* is found in pure water, and moves alternately towards the right and left. It is quadrangular, and pellucid, with 16 spherical molecules of a greenish colour, "set in a quadrangular membrane, like the jewels in the breast-plate of the high-priest, reflecting light on both sides."

2. The *pulvinatum* is found in dunghills; and appears like a little quadrangular membrane, plain on both sides: but with a large magnifier it appears like a bolster formed of three or four cylindric pillows sunk here and there.

3. The *corrugatum* is found in various kinds of infusions; and is somewhat of a square shape, very small and in some positions appears as streaked.

4. The *rectangulum* differs but little from the former: the angle at the base is a right one; the larger vesicle is transparent, the rest green.

5. The *truncatum* is found chiefly in pure water and then but seldom. It has a languid motion, and much larger than the foregoing. The fore part is a straight line, with which the sides form obtuse angles, the ends of the sides being united by a curved line. The internal molecules are of a dark green, and there are two little bright vesicles in the middle.

X. *Bursaria.*

A very simple, hollow, membranaceous worm.

1. The *truncatella* is visible to the naked eye; white oval, and truncated at the top, where there is a large aperture descending towards the base. Most of them have four or five yellow eggs at the bottom. They move from left to right, and from right to left; ascending to the surface in a straight line, and sometimes rolling about while they descend.

2. The *bullina* is pellucid and crystalline, having splendid globules of different sizes swimming about with it. The under side is convex, the upper hollow, with the fore part forming a kind of lip.

3. The *hirundinella*, has two small projecting wings, which give it somewhat of the appearance of a bird; and it moves something like a swallow. It is invisible to the naked eye; but by the microscope appears a pellucid hollow membrane.

4. The *duplella* was found among duckweed, and appears like a crystalline membrane folded up, without any visible intestines except a small congeries of points under one of the folds.

5. The *globina* has a roundish shape, and is hollow; the lower end being furnished with black molecules of different sizes, the fore part with obscure points, the rest entirely empty, and the middle quite transparent. It moves very slowly from right to left.

XI. *Circaria.*

An invisible transparent worm with a tail.

1. The *gyrinus* greatly resembles the spermatic animalcules. It has a white gelatinous body; the fore part somewhat globular; the hind part round, long, and pointed. Sometimes it appears a little compressed on each side. When swimming it keeps its tail in continual vibration like a tadpole.

2. The *gibba* is found in the infusions of hay and other vegetables; and is small, opaque, gelatinous, white, and without any visible intestines.

3. The *inquieta* is found in salt-water, and is remarkable for changing the shape of its body: sometimes it appears spherical, sometimes like a long cylinder, and sometimes oval. It is white and gelatinous, the tail filiform and flexible, the upper part vibrating violently. A pellucid globule may be observed at the base, and two very small black points near the top.

4. The *lemna* varies its form so much, that it might be mistaken for the proteus of Baker, described under the article ANIMALCULE; though in fact it is totally different. The body sometimes appears of an oblong, sometimes of a triangular, and sometimes of a kidney shape. The tail is generally short, thick, and annulated; but sometimes long, flexible, cylindric, and without rings; vibrating, when stretched out, with so much velocity, that it appears double. A small pellucid globule, which Muller supposes to be its mouth is observable at the apex; and two black points not easily discovered, he thinks, are its eyes. Sometimes it draws the tail entirely into the body. It walks slowly after taking three or four steps, and extends the tail, erecting it perpendicularly, shaking and bending it; in which state it very much resembles a leaf of the lemna.

5. The *turbo*, with a tail like a bristle, is found among duckweed. It is of a talcy appearance, partly oval and partly spherical; and seems to be composed of two globular bodies, the lowermost of which is the smallest, and it has two little black points like eyes on the upper part. The tail is sometimes straight, sometimes turned back on the body.

6. The *poduria* is found in November and December, in marshy places covered with lemna. It is pellucid; and seems to consist of a head trunk, and tail: the head resembles that of a herring; the trunk is ventricose and full of intestines, of a spiral form and black colour. The tail most commonly appears to be divided into two bristles. The intestines are in a continual motion when the body moves and by reason of their various shades make it appear very rough. There are likewise some hairs to be perceived. It turns round as upon an axis when it moves.

7. The *viridis*, is found in the spring in ditches of standing water; and in some of its states has a considerable resemblance to the last, but has a much greater power of changing its shape. It is naturally cylin-

lindrical, the lower end sharp, and divided into two parts; but sometimes contracts the head and tail so as to assume a spherical figure.

8. The *setifera* is found in salt-water, but seldom. It is small, the body rather opaque and of a round figure. The upper part is bright, and smaller than the rest: the trunk is more opaque; the tail sharp, and near it a little row of short hairs. It has a slow rotatory motion.

9. The *hirta* was likewise found in salt-water. It is opaque and cylindrical; and when in motion, the body appears to be surrounded with rows of small hairs separated from each other.

10. The *crumena* has a ventricose, cylindrical, thick, and wrinkled body; the lower part small; the upper part terminating in a small straight neck like that of a pitcher; the tail linear, and terminating in two diverging points,

11. The *catellus* has a moveable head fixed to the body by a point. The abdomen is twice as long as the head, full of intestines, and has a tail still narrower, and terminating in two bristles which it can unite and separate at pleasure. It moves briskly, but without going far from its first place.

12. The *catelina* was found in a ditch where there was plenty of duckweed. It is larger than the preceding, and has a thicker and more cylindrical body; the lower part truncated, with two short diverging points projecting from the middle.

13. The *lupus*, is found in water among duckweed, and is larger than most of the genus. The head is larger than the body; the apex turned down into a little hook; the tail is like the body, but narrower, terminating in two very bright spines, which it extends in different directions. Sometimes it contracts into one half its common size, and again extends itself as before.

14. The *vermicularis* is long, cylindrical, fleshy, and capable of changing its shape. It is divided into eight or nine rings or folding plaits; the apex either obtuse, or notched into two points; the hinder part rather acute and terminating in two pellucid thorns, between which a swelling is sometimes perceived. It often projects a kind of cloven proboscis from the incision at the apex. It is found in water where there is duckweed.

15. The *forcipata* is found in marshy places, is cylindrical and wrinkled, with a forked proboscis which it can thrust out or pull in.

16. The *pleuronectes* is found in water which has been kept for several months. It is membranaceous, roundish, and white, with two blackish points in the fore part, the hinder part being furnished with a slender sharp tail. It has orbicular intestines of different sizes in the middle; the larger of them bright. The motion is vacillatory; and in swimming it keeps one edge of the lateral membrane upwards, the other folded down.

17. The *tripos* is flat, pellucid, triangular, having each angle of the base or fore part bent down into two linear arms, the apex of the triangle prolonged into a tail. It is found in salt water.

18. The *cyclidium* is frequently found in pure water, and has an oval, smooth, membranaceous, pellucid body with a black margin. The tail is concealed under the edge, and comes out from it at every motion, but in such a manner as to project but little from the edge. There is also a kind of border to the hinder part.

19. The *tenax* appears like an oval pellucid membrane, something larger than the *monas lens*. The fore edge is thick and truncated; the hinder part acute, and terminating in a short tail. It whirls about in various directions with great velocity.

20. The *discus* is a small orbicular animalcule, with a bent tail.

21. The *orbis* is round, and has a tail consisting of two long bristles.

22. The *luna* is likewise round, and has the fore-part hollowed into the form of a crescent.

XII. *Leucophra.*

An invisible, pellucid, and ciliated worm.

1. The *conflictor*, with moveable intestines, is perfectly spherical and semitransparent, of a yellow colour, the edges dark. It rolls from right to left, but seldom removes from the spot where it is first found. It is filled with a number of the most minute molecules, which move as if they were in a violent conflict; and in proportion to the number of these little combatants which are accumulated either on one side or other, the whole mass rolls either to the right or left. It then remains for a little time at rest, and the conflict ceases; but it soon becomes more violent, and the sphere moves the contrary way in a spiral line. When the water begins to fail, they assume an oblong, oval, or cylindric figure; the hinder part of some being compressed into a triangular shape, and the transparent part escaping as it were from the intestines, which continue to move with the same violence till the water fails, when the molecules shoot into a shapeless mass, which also soon vanishes, and the whole assumes the appearance of crystals of sal ammoniac.

2. The *mamilla* is of a dark colour, and filled with globular molecules; short hairs are curved inwards; and it occasionally projects and draws in a little white protuberance. It is pretty common in marshy water.

3. The *virescens* is a large, pear-shaped, greenish-coloured animalcule, filled with opaque molecules, and covered with short hairs; generally moving in a straight line. It is found in salt water.

4. The *viridis* is much smaller than the former, and cannot lengthen or shorten itself as it does. Sometimes it appears contracted in the middle, as if it were to be divided in two.

5. The *bursata* is found in salt water, and is similar in many respects to the former. It is of a long oval shape, bulging in the middle, and filled with green molecules, every where ciliated except at the apex, which is truncated and shaped somewhat like a purse; the hairs are sometimes collected into little fascicles.

6. The *posthuma* is globular, and covered as it were with a pellucid net; it is found in fetid salt water.

7. The *aurea* is yellow, oval; has both ends equally obtuse; little hairs discovered with difficulty; and has in general a vehement rotatory motion.

8. The *pertusa* is found in salt water; and is gelatinous

tinous and small, without any molecules. The fore-part is truncated, the hind-part brought nearly to a point, with a kind of oval hole on one side.

9. The *fracta* is long, with sinuated angles, white, gelatinous, and granulated, changing its form considerably.

10. The *dilatata* appears like a gelatinous membrane, with a few grey molecules in the fore-part, and a great number in the hinder part. It is sometimes dilated into a triangular form with sinuated sides; at other times the shape is more irregular and oblong.

11. The *scintillans* was found in December among the lesser lemnæ. It is of a green colour, oval, round, and opaque. It is supposed to be ciliated from its bright twinkling appearance, which probably arises from the motion it gives the water.

12. The *vesiculifera* is oval, very pellucid, with a defined dark edge and inside, containing some very bright bladders or vesicles. The middle frequently appears blue, and the vesicles appear as if set in a ground of that colour.

13. The *globulifera* was found in a ditch where the lemna minor grew. The body is round, very pellucid, without molecules, but with three little pellucid globules, and every where set with short hairs.

14. The *pustulata* is found in marshy waters; and is white, gelatinous, and somewhat granulated; the lower part truncated as if an oblique section were made in an egg near the bottom. It is covered with little erect shining hairs, and at the lower extremity a few bright pustules may be discovered.

15. The *turbinata* is found in stinking salt water; and is round, pellucid, somewhat of the shape of an acorn, with a pellucid globule at the lower end.

16. The *acuta* is found in salt water, and is gelatinous, thick, capable of assuming different shapes; having the apex bright, and the rest of the body filled with little spherules. Sometimes it draws itself up into an orbicular shape, at others one edge is sinuated.

17. The *notata* is oval, round, and has a black point at the edge.

18. The *candida* is found in salt water; and is membranaceous, flat, very white, with no visible intestines except two oval bodies not easily perceived. The whole edge is ciliated.

19. The *nodulata* is oblong and oval, with a double row of little nodules.

20. The *signata* is common in salt water in the months of November and December. It is oblong and subdepressed, with a black margin filled with little molecules, but more particularly distinguished by a curved line in the middle somewhat in the shape of the letter S; one end of which is sometimes bent into the form of a small spiral.

21. The *trigona* is found in marshes, but not commonly. It is a yellow triangular mass filled with unequal pellucid vesicles, one of which is much larger than the rest, and the edge surrounded with short fluctuating hairs.

22. The *fluida* is somewhat of a kidney shape, but ventricose.

23. The *fluxa* is reniform and sinuated.

24. The *armilla* is round and annular.

25. The *cornuta* is of the shape of an inverted cone, opaque, and of a green colour. This requires to be observed for some time before we can ascertain its characters. The body is composed of molecular vesicles; the fore part is wide and truncated, with a little prominent horn or hook on both sides; the hind part being conical, every where ciliated, and the hairs exceedingly minute; those in the fore part are three times longer than the former, and move in a circular direction. The hinder part is pellucid, and sometimes terminates in two or three obtuse pellucid projections. At one time this animalcule will appear reniform and ciliated on the fore part; but at another time the hairs are concealed. It dissolves into molecular vesicles when the water evaporates.

26. The *heteroclita* appears to the naked eye like a white point; in the microscope as a cylindrical body, the fore part obtusely round, the middle rather drawn in; the lower part round, but much smaller than the upper part. It appears wholly ciliated through a large magnifier.

XIII. *Trichoda.*

An invisible, pellucid, hairy worm.

1. The *grandinella* is a very small pellucid globule, with the intestines scarce visible, the top of the surface furnished with several small bristles not easily discoverable, as the creature has a power of extending or drawing them back in an instant. It is found in pure water as well as in infusions of vegetables.

2. The *cometa* is a pellucid globule filled with bright intestines, the fore part furnished with hairs, the hind part with a pellucid globule.

3. The *granata* resembles the two former; and has a darkish nucleus in the centre, with short hairs on the edge.

4. The *trochus* is somewhat of a pear-shape, and pellucid; each side of the fore part being distinguished by a little bunch of hairs.

5. The *gyrinus* is one of the smallest of this genus, and is found in salt water. It is smooth and free from hairs, except at the fore part, where there are a few.

6. The *sol* is small, globular, and crystalline; beset every where with diverging rays longer than the diameter of the body; the inside full of molecules. The body contracts and dilates, but the creature remains confined to the same spot. It was found with other animalcules in water which had been kept three weeks.

7. The *solaris* is orbicular, bright, and filled with globular intestines, frequently having in it a moveable substance of the shape of the letter S. It has hairs seldom exceeding 17 in number, set round the circumference, each of them nearly equal in length to the diameter of the animalcule.

8. The *bomba* is of a yellow colour, and full of clay-like molecules. It moves with such velocity as to elude the sight, and appears of various shapes, sometimes spherical, sometimes kidney-shaped, &c.

9. The *orbis* is composed of vesicular molecules; is of a spherical figure, smooth pellucid, and a little notched in the fore part. The notched part is filled with long hairs, but there are none on the rest of the body.

10. The *urnula* is membranaceous, pellucid, somewhat in the form of a water pitcher, with the fore part hairy. It moves but slowly.

11. The *diota* is of a clay-colour, and filled with molecules;

molecules; the upper part cylindrical and truncated the lower part spherical, the upper part of the mouth hairy at the edges,

12. The *horrida* is somewhat of a conical shape, the fore part rather broad and truncated, the lower part obtuse, and the whole covered with radiating bristles.

13. The *urinarium* is egg-shaped, with a short hairy beak.

14. The *semiluna* is smooth, pellucid, and shaped like a crescent.

15. The *trigona* is of a triangular shape, a little convex on both sides, the fore part acute and ciliated, the hind part broader, and having the extremity as it were gnawed off.

16. The *tinea* is round, not very pellucid, narrow in the fore part, and resembling an inverted club.

17. The *nigra* was found in salt water, and has an opaque body; but when at rest one side appears pellucid. When in violent motion, it seems entirely black.

18. The *pubes* is found in water where duckweed grows, chiefly in the month of December. It has a bunch above the hind part marked with black spots, depressed towards the top, a little folded, and somewhat convex on the under part. The apex is furnished with hairs, but they are seldom visible till the creature is in the agonies of death, when it extends and moves them vehemently, and attempting as it were to draw in the very last drop of water.

19. The *floccus* is membranaceous, the fore part rather conical, with three small hairy papillæ projecting from the base.

20. The *sinuata* is found in river water. It is oblong and depressed, with one margin hollow and hairy, and the lower end obtuse. It is of a yellow colour, and the hollow edge ciliated.

21. The *præceps* is pellucid, the fore part formed into a kind of neck; one edge rising into a protuberance like a hump-back, the other edge convex.

22. The *proteus* is that which Mr Baker distinguishes by the same name, and of which an account is given under the article ANIMALCULE. It is found in the slimy water adhering to the sides of vessels in which vegetables have been infused, or animal substances preserved. That described by Mr Adams was discovered in the slime produced from the water where small fishes, water-snails, &c. had been kept. The body resembled that of a snail, the shape being somewhat elliptical, but pointed at one end, while from the other proceeded a long, slender, and finely proportioned neck, of a size suitable to the rest of the animal.

23. The *versatilis* lives in the sea, and has some resemblance to the proteus; but the neck is shorter, the apex less spherical, and the hinder part of the trunk acute.

24. The *gibba* is pellucid; the upper part swelled out, with numerous molecules, and three larger globules on the inside. The ends rather inclined downwards; and when the water begins to fail, a few minute hairs may be discovered about the head and at the abdomen; the body then becomes striated longitudinally.

25. The *foeta* somewhat resembles a rolling-pin in shape; has both ends obtuse, and one shorter than the other. It can draw in the ends, and swell out the sides, so as to appear almost spherical.

26. The *patens* is found in salt water; and is of a long cylindrical shape, filled with molecules, the fore-part bright and clear, with a long opening near the top which tapers to a point, and is beset with hairs.

27. The *patula* is ventricose, rather inclining to an oval figure, with a small tube at the fore part, the upper part of which is hairy.

28. The *foveata* is oblong and rather broad, with three little horns on the fore part.

29. The *striata* is found in the month of December in river-water. It is a beautiful animalcule, of a fox colour. It is of an oblong shape, the lower end somewhat larger than the other. It has a set of streaks running from one end to the other, and at the abdomen a double row of little eggs lying in a transverse direction.

30. The *uvulva* is found in the infusion of hay and other vegetables. It is six times longer than broad, round, flexuous, of an equal size, the greater part filled with obscure molecules; the fore part rather empty, with an alimentary canal and lucid globules near the middle. The margin of the forepart is covered with short hairs.

31. The *aurantia* is of a gold colour, pellucid, and filled with vesicles.

32. The *ignita* is of a fine purple colour, with something of a reddish cast, pellucid, splendid, with a number of globules of different sizes; the fore part small, the hinder part obtuse, with a very large opening which seems to run through the body.

33. The *prisma* is very small, and so transparent that it cannot easily be delineated. It is of a singular shape; the under part being convex, the upper compressed into a kind of keel, and the fore part small.

34. The *forceps* is found about the winter solstice in water covered with lemna. It is of a yellow colour, large, somewhat transparent, and filled with molecules, with a large opaque globule in the lower part. The fore part is divided into long lobes, one of which is falciform and acute, the other dilated and obliquely truncated. It can open, shut, or cross, those lobes at pleasure; and by the motion of them it appears to suck in the water.

35. The *forfex* is found in river water. It has the fore part formed into a kind of forceps, one of which is twice as long as the other, hooked and ciliated.

36. The *index* is found in salt water, and has the under part of the front of the margin hairy; the apex is formed by the fore part projecting like a finger on a direction post.

37. The *trichoda* is of a yellow colour, formed of two pellucid membranes striated longitudinally; the lower end obliquely truncated, and the two extremities bent in opposite directions.

38. The *navicula* has three corners; the fore part truncated and ciliated, the hind part acute and bent a little upwards. It has a crystalline appearance and a kind of longitudinal keel runs down the middle.

39. The *succisa* is of a flattened oval shape, the edge hairy, and hollowed out in such a manner as to form two unequal legs.

40. The *sulcata* is ovated and ventricose, the apex acute, with a furrow at the abdomen, and both sides of it ciliated.

41. The *anas* is found in pure water; and is smooth, five

Microscope

five times broader than it is long, filled with darkish molecules. It has a bright neck, under the top of which are a few unequal hairs. It moves but languidly.

42. The *barbata* is round, somewhat linear, with both ends obtuse; the fore part narrower, forming as it were a kind of neck, under which is a row of fluctuating hairs. The trunk is full of grey molecules.

43. The *farcimen* is long, round, pellucid, and covered with very minute hairs, and has a great number of mucous vesicles about the body.

44. The *crinita* is long, round, every where ciliated on the upper part, and the under part likewise hairy as far as the middle.

45. The *angulus* is long, more convex than most of the genus, divided by a kind of articulation in the middle into two parts equal in breadth, but of different lengths; the apex has short waving hair.

46. The *linter* is found in an infusion of old grass. It is egg-shaped, oblong, with both extremities raised so that the bottom becomes convex, and the upper part depressed like a boat: it is of different shapes at different ages, and sometimes has a rotatory motion.

47. The *paxillus* is found in salt water; and is long, full of grey molecules; the fore part truncated and hairy, and rather smaller than the other.

48. The *vermicularis* is found in river water; and is pellucid in the fore part, with the hind part full of molecules.

49. The *melitæa* is found in salt water, but very rarely. It is oblong, ciliated, with a globular apex, a dilatable neck, and a kind of peristaltic motion perceivable within it.

50. The *fimbriata* is subovated, the apex hairy, the hinder part obliquely truncated and serrated.

51. The *camelus* is found but rarely in vegetable infusions, and moves in a languid manner. The fore part is ventricose; the back divided by an incision in the middle into two tubercles; the lower part of the belly sinuated.

52. The *augur* is oblong, depressed, pellucid, and filled with molecules: the vertex is truncated, the forepart forming a small beak with three feet underneath; beyond which, toward the hinder part, it is furnished with bristles.

53. The *pupa* is roundish, pellucid, and consists of three parts. The head is broad, and appears to be hooded, the top being furnished with very small hairs; on the lower part of the head is a transparent vesicle, and over the breast from the base of the head hangs a production resembling the sheath of the feet in the pupa of the gnat.

54. The *lunaris* is round and crystalline; the hinder part smaller than the other. The edge of the back and the part near the tail are bright and clear. It bends itself into the form of an arch.

55. The *bilunis* is arched and flattened with an hairy apex, and two little bristles proceeding from the tail.

56. The *rattus* is oblong, with a kind of keel; the fore part hairy, and a very long bristle proceeding from the hinder part.

57. The *tigris* resembles the former, but differs in the form of the tail, which consists of two bristles, and likewise in having a kind of incision in the body a little below the apex.

58. The *perillum* is frequently found in marshes. It is cylindrical, pellucid, muscular, and capable of being folded up. It appears double; the interior part full of molecules, with an orbicular muscular appendage, which it can open and shut, and which forms the mouth. The external part is membranaceous, pellucid, dilated, and marked with transverse streaks; and it can protrude or draw in the orbicular membrane at pleasure. Some have four articulations in the tail, others five; and it has two pairs of bristles, one placed at the second joint, the other at the last.

59. The *clavus* has a considerable resemblance to a common nail; the fore part is round and hairy, the hinder part terminating in a sharp tail.

60. The *cornuta* is membranaceous, elliptical, full of molecules; the fore part lunated, the other round, and terminating in a tail as long as the body.

61. The *gallina* is found in river water. It is of a grey colour, flat, with seven large molecules and globules within it; the front obtuse, set with hairs; the hinder part terminating in a tail formed of very fine hairs.

62. The *musculus* is found in the infusions of hay which have been kept for some months. It is smooth, egg-shaped, with a double margin drawn underneath it: the fore part narrow, and furnished with short hairs which continually play about; having a small tail underneath. It moves slowly, and is furnished with molecular intestines.

63. The *delphis* is found in river water. It is smooth, pellucid, having the forepart dilated into a semicircle, gradually decreasing in breadth towards the tail. The front is hairy, the hairs standing as rays from the semicircular edge: one of the edges is sometimes contracted.

64. The *delphinus* is found in hay that has been infused for some months. It is pellucid, smooth, and egg-shaped; the hinder part terminating in a tail about half the length of the body, dilated at the upper end, truncated, and always bent upwards. It moves sometimes on its belly and sometimes on its side.

65. The *clava*, or club trichoda, has the fore part thick, but the hinder part narrow; both extremities obtuse, pellucid, and replete with molecules; the hind part bent down towards the middle.

66. The *cuniculus* is oblong, the fore part hairy, the hinder part rather acute, and filled with molecules and black vesicles.

67. The *felis* is large and curved, the fore part small, the hinder part gradually diminishing into a tail, the under part beset with hairs longitudinally.

68. The *piscis* is oblong, the fore part hairy, the hind part terminating in a very slender tail. It is smooth pellucid, much longer than broad, and filled with yellow molecules; the fore part obtuse, the hinder part extremely slender and transparent, the upper side convex.

69. The *larus* is long, round, beset with hairs, and has the tail divided into two points.

70. The *longicauda* is cylindrical; the fore part truncated, and beset with hairs; the tail long, furnished with two bristles, and having two joints.

71. The *fixa* has the circumference set with hairs, and a little solitary pedicle projecting from the body.

72. The *inquilinus* is sheathed within a cylindrical transparent

Microscope transparent bag, having a little pedicle bent back within the bag.

73. The *ingenita* is sheathed in a depressed bag, broadest at the base. The animalcule itself is funnel-shaped, with one or more hairs proceeding from each side of the mouth of the funnel. It can extend or contract itself within the bag, fixing its tail to the base, without touching the sides. It is found in salt water.

74. The *innata* is sheathed in a cylindrical bag, with a pedicle passing through and projecting beyond it.

75. The *transfuga* is broad, the fore part hairy, the hinder part full of bristles; one side sinuated, and the other pointed.

76. The *ciliata* is ventricose, the hinder part covered with hair.

77. The *bulla* is membranaceous, the sides bent inwards; the fore and hind parts both covered with hairs.

78. The *pellionella* is somewhat thick in the middle, and pellucid, with a few molecules here and there; the sides obtuse, the fore part ciliated with very fine hairs, the hinder part set with bristles.

79. The *cyllidium* has the hinder extremity filled with globules of various sizes. It vacillates upon the edge, commonly advancing on its flat side, and continually drawing in water. It then gapes, and opens into a very acute angle, almost to the middle of the body; but this is done so instantaneously, that it can scarce be perceived.

80. The *cursor* is oval, the fore part hairy, and the hinder part also furnished with some straight and curved hairs in two fascicles. Its body is flat, and filled with molecules; and in the fore part is an oblong empty space, into which we may sometimes see the water sucked in.

81. The *pulex* is egg-shaped, with an incision in the fore part; the front and base hairy.

82. The *lynceus* is nearly square, with a crooked beak and hairy mouth. It is membranaceous, and appears compressed, stretched out into a beak above, under which there is a little bundle of hairs; the lower edge bends in and out, and is surrounded with a few bristles. The intestines are beautiful, and a small bent tube goes from the mouth to them in the middle of the body. There is likewise another tube between the fore and hind edge, filled with blue liquor. The intestines and other tube are frequently in motion.

83. The *erosa* is orbicular, the fore part notched; one side furnished with hairs, the hinder part with bristles.

84. The *rostrata* is found in water where duckweed has been kept. It is depressed, capable of changing its shape, yellow, with long ciliated hairs; it has four feet tapering to a point, one of them longer than the rest. Both feet and hairs are within the margin. The shape of the body is generally triangular; the apex formed into an obtuse beak, which the creature sometimes draws in so that it appears quite round.

85. The *lagena* is round, ventricose, with a long neck, and the lower end set with bristles.

86. The *charon* was found in salt water. It is oval, and resembles a boat as well in its motion as shape: the upper part is hollowed, the under part furrowed and convex; the stern round, with several hairs proceeding from it. Microscope

87. The *cimex* is about the size of the lyncus, has an oval body, with a convex back, flat belly, and incision in the margin of the fore part, the edges of which incision appear to move. When this animalcule meets with any obstacles in swimming, it makes use of four bristles, which appear on the under side as feet.

88. The *cicada* differs but little from the cimex. It is oval, with an obscure margin, the fore part covered with hairs on the under side, and the hinder parts beardless.

XIV. *Kerona*
An invisible worm with horns.

1. The *rastellum* is found in river water. It has three rows of horns on the back, which occupy almost the whole of it.

2. The *lyncaster* is square, and its disc furnished with shining horns.

3. The *histrio* appears an oblong membrane, pellucid, with four or five black points in the fore part, which are continually changing their situation, thick set with small globules in the middle, among which four larger ones are sometimes perceived, which by Mr Adams are supposed to be eggs. In the middle of the hind part are some longitudinal strokes resembling bristles, which, however, do not seem to project beyond the body.

4. The *cypris* is found in water covered with lemna. It is somewhat of a pear shape, compressed, with a broad and blunt fore part; the front furnished with hairs or little vibrating points inserted under the edge, shorter in the hind part, partly extended straight, and partly bent down, having a retrograde motion.

5. The *haustrum* is orbicular, with the horns in the middle, the fore part membranaceous and ciliated, with several bristles at the hinder part.

6. The *haustallum* differs from the preceding only in having the hinder part without any bristles.

7. The *patella* has an univalved shell, is orbicular, crystalline; the fore part somewhat notched; the fleshy body in the middle of the shell; with horns or hairs of different lengths jutting out beyond the shell, and acting instead of feet and oars, some of which are bent; and the superior ones constitute a double transverse row.

8. The *vannus* is oval and rather flat, with one edge bent, the opposite one ciliated, the front furnished with horns, and the hind part with bristles.

9. The *pullaster* agrees in many respects with the *trichoda pulex*; the upper part is pellucid, without any black molecules; the front truncated, the whole surface of the head covered with hair, and the fore part sinuous.

10. The *mytillus* is a large animalcule; the fore and hind parts rounded, very pellucid and white, dark in the middle, with black intestines intermixed with a few pellucid vesicles; both extremities appearing as if composed of two thin plates. It has two small horns, with which it agitates the water so as to form a little whirlpool.

11. The *lepus* is egg-shaped, compressed, pellucid, and

and crowned with short waving hairs; the base terminated with bristles.

12. The *siluris* is an oval, smooth, animalcule, somewhat crooked and opaque, with a fascicle of vibrating hair on the fore part: it has a sharp tail furnished with unequal rows of moveable hairs, the back being also ciliated: the hairs produce a rotatory motion. The figure varies from oval to oblong, and the filaments of the conferva are often entangled in the tail.

13. The *calvitium* is found in the infusion of vegetables. The body is broad and flat, both sides, obtuse, filled with black molecules, and there is a black spot near the hinder part, where there are likewise a few short bristles.

14. The *pustulata* is found in salt water. It is oval, convex; one edge of the hinder part sinuated, both ends set with hairs, and some horns on the fore-part.

XV. *Himantopus:*
A pellucid, invisible, and cirrated worm.

1. The *acarus* is lively, conical, ventricose, full of black molecules, with a bright and transparent fore part. The lower part of the apex has rows of long hairs on the under part set like rays. Four locks of long crooked hair or feet proceed from the belly, and it is continually moving these and other hairs in various directions.

2. The *ludio* is a lively diverting animalcule, smooth, pellucid, full of small points, the fore part clubbed and a little bent, the hinder part narrow; the base obliquely truncated, and terminating in a tail stretched out transversely. The top of the head and middle of the back are furnished with long and vibrating hairs; three moveable and flexible curls hang down from the side of the head at a distance from each other. When the creature is at rest, its tail is curled; but when in motion, it is drawn tight and extended upwards.

3. The *sannio* is found, though seldom, in water where the lemna grows. The cilia are longer than the hairs, and are continually vibrating; it has two moveable curls hanging on the side of the head.

4. The *volutator* is shaped like a crescent, and has some crystalline points; the convex part has a row of hairs longest towards the tail, and underneath are four feet. It is very lively, and often turns round with a swift circular motion.

5. The *larva* is long and cirrated in the middle; the body is depressed and long; the hinder part acute, and generally curved, pellucid, and filled with granular molecules.

6. The *charon* is found in sea-water, but rarely. It is oval, pellucid, and membranous, with longitudinal furrows, and several bent diverging rows of hair below the middle, but none on the hinder part.

7. The *corona* is a membranous lamina, very thin, pellucid, crystalline, and semilunar: the edge of the base thick set with molecular intestines; the fore part furnished with a kind of mane; towards the hind part are three equal curved hairs or spines.

XVI. *Vorticella:*
A naked worm with rotatory cilia, capable of contracting and extending itself.

1. The *viridis* is visible to the naked eye, appearing like a small green point; but the microscope discovers it to be nearly cylindrical, a little thicker at the fore part than the other, and obtuse at both ends. It appears to be totally destitute of limbs, notwithstanding which it keeps the water in continual motion; so that it probably has some invisible rotatory instrument. It moves sometimes circularly, sometimes in a straight line.

2. The *sphero'da* appears also like a point; but thro' the microscope is a globular mass of a dark green colour. It occasions a vehement motion in the water, probably by means of some short hairs with which it is furnished.

3. The *cincta* is of an irregular shape, sometimes assuming an oval figure, and appearing as if girt round with a transverse keel. It is invisible to the naked eye, ciliated on every side; the hairs all moveable, and longer on one side than the other.

4. The *lunifera* is found in salt water; has the fore-part obtuse, the base broad, and hollowed away like a crescent, with a short protuberance in the middle of the concave part: the fore part is ciliated.

5. The *bursata* is found in salt water, and is ventricose crammed, with molecules; the fore-part truncated, and both sides of it pellucid: there is a prominent papilla in the middle, which when the animalcule is at rest appears notched, the edge of the aperture being ciliated; the hairs are capable of moving in various directions.

6. The *varia* is cylindrical, truncated, opaque, and blackish coloured, the fore part ciliated.

7. The *sputarium* is found in October, with the lesser lemna, and is one of the most singular of the microscopic animalcules. When viewed sidewise, it is sometimes nearly cylindrical, only tapering a little towards the hinder part, and having a broad pellucid edge. Viewed from the top, it has sometimes a broad face or disc, furnished with radiating hairs, the under part contracted into a globular shape, of a dark green colour, and filled with small grains.

8. The *polymorpha* is visible to the naked eye, and appears like a green point moving with great agility; but when viewed through a microscope, it assumes such a variety of forms, that it is impossible to describe them. The body is granulous; and a series of pellucid points is sometimes to be observed.

9. The *multiformis* is found in salt water, and very much resembles the former.

10. The *nigra* is found in August in meadows covered with water. It may be seen with the naked eye, appearing like a black point swimming on the surface. Through the microscope it appears as a small conical body, obtuse and ventricose at one end, and acute at the other. When the extremities are extended, two small white hooks become visible, by the assistance of which it moves in the water, and it probably has a rotatory organ: it moves continually in a vacillating manner on the top of the water.

11. The *cucullus* is likewise visible to the naked eye: it is of a dirty red colour, of a shape somewhat conical, and resembling a grenadier's cap.

12. The *utriculata* is green and ventricose; the belly capable of being lengthened or shortened; the fore part truncated, much in the shape of a common water bottle;

bottle; the neck is sometimes very long, sometimes very short, and filled with green molecules.

13. The *ocreata* is met with in rivers, though very seldom, and in shape somewhat resembles the lower part of a boot. The apex of the upper part is truncated and ciliated, the heel pointed, and the foot round.

14. The *valga* is as broad as long, and the apex truncated and ciliated; both angles of the base projecting outwards, one somewhat like a wart, the other like a finger: It is found in marshy waters.

15. The *papillaris* is likewise found in marshes where the conferva nitida grows. It is ventricose; the fore part truncated, with a papillary tail, and a beautiful papillary excrescence on the side.

16. The *sacculus* is thick, of an equal diameter every where, and full of molecules. The edge of the mouth is bent back; the hinder part is obtuse, sometimes notched and contracted, with cilia to be seen on both sides of the mouth.

17. The *cirrata* is found in ditch-water. It is ventricose, the aperture sinuated, and two tufts of hair on each side of the belly.

18. The *nasuta* is invisible to the naked eye, but the microscope discovers it to be furnished with a rotatory organ encompassing the middle. It is pellucid, cylindrical of an unequal size; the fore part truncated and ciliated, with a triangular prominence in the middle of the aperture; the hinder part is obtuse, with a point on each side of the middle of the body. When the water is nearly exhaled, two rotatory organs are observable; one on the fore part, and the other encompassing the middle of the body; the hairs of the latter being in violent motion. Other fascicles of moving hair are likewise to be observed; and the quick and various motions of this apparatus are very surprising.

19. The *stellina* is of an orbicular shape, with a molecular disc and ciliated margin.

20. The *discina* is likewise orbicular, the edge ciliated, with a kind of handle on the under side.

21. The *scyphina* is bowl-shaped, crystalline, with an opaque spherule in the middle.

22. The *albina* is cylindrical in the fore part, the hinder part tapering, and almost ending in a point.

23. The *fritillina* is empty and cylindrical, with a truncated apex.

24. The *truncatella* is of the larger kind of animalcules with a crystalline body, full of black molecules, the skin perfectly smooth and colourless, the hinder extremity rounded, and the anterior part truncated; at this extremity there is a large opening that serves for a mouth, which is thickly ciliated.

25. The *limacina* is cylindrical, truncated, and has two pair of cilia.

26. The *fraxinina* is mostly cylindrical, the hinder part rather tapering, and full of opaque molecules; transparent towards the upper end. Within the edge at the top are two small tubercles, from each side of which proceeds a pair of small hairs.

27. The *cratagaria* is found in the month of April, both in the mud and on the tail of the monoculus quadricornis. They are generally heaped together in a spherical form, and united to one common stalk. They are likewise often to be found without a pedicle, the body rather contracted, the aperture circular, and surrounded with a marked margin. It has two small arms; and with a powerful magnifier a violent rotatory motion may be observed. Sometimes an individual will separate from the community, and move in a kind of spiral line for a little time, and then go back to the rest.

28. The *hamata* is not ciliated, nor has it any hairs upon it; the body is granulated, the fore part broad and truncated, the hinder part obtuse, and capable of being contracted or extended.

29. The *crateriformis* is a lively animalcule, pellucid, round, longer than it is broad, approaching somewhat to a square figure, with convex sides: the head is situated at the large end, the skin smooth, and some traces of intestines may be discovered with difficulty. There is a considerable opening surrounded by hair at the larger end, and the filaments composing it are in continued motion. Two of them are sometimes seen joined together, and full of small spherules. In this state they draw each other alternately different ways; the surface is smooth, and the hairs invisible.

30. The *canaliculata* appears to the naked eye as a number of white points adhering to the sides of the glass. When magnified, the fore part is narrower than the hind one; in the side is a kind of incision, and the hinder part is notched towards the middle. It excites a continual whirling motion in the water by means of a rotatory organ with which it is furnished.

31. The *versatilis* is a pellucid, gelatinous animalcule, of a greenish colour, and furnished with small radii about the circumference; so that it appears like a very small water hedge-hog.

32. The *ampula* is contained in a transparent bottle-shaped bag; the head divided into two lobes. It sometimes lies at the bottom of the bag, and sometimes nearly fills the whole of it.

33. The *folliculata* is gelatinous and cylindrical; and when most extended, the base appears attenuated, and the apex truncated.

34. The *larva* is of a clay colour, the aperture ciliated, with a globular projection at times appearing to proceed from it.

35. The *sacculata* has the shape of an inverted cone, with an aperture in the figure of a crescent; the lower part of the trunk notched, forming as it were two teeth; the tail biphyllous. Each of these is surrounded with a loose bright skin, the head being divided from the trunk by a deep incision.

36. The *aurita* is cylindrical and ventricose, the aperture destitute of hairs; both sides of it are furnished with rotatory cicila, and the tail is biphyllous.

37. The *tremula* has something of a conical shape; the mouth being divided into parts which are set with small spines; and a point projects from the tail.

38. The *ferita* is muscular, pellucid, folding variously, the fore part truncated: round the margin are rows of hairs; but it has also stiffer hairs or spines continually vibrating, with which it draws in all animate and inanimate substances which it is able to manage.

39. The *lacinulata* is shaped like an inverted cone, the aperture lobated, the tail small and furnished with two bristles. When swimming, the rotatory organ may be discovered. It moves swiftly in an oblique direction.

40. The

40. The *constricta* is of two kinds; *viz.* of a pale yellow and of a white colour. They move by fixing their tail to the place where they are, and then extending their body as much as possible; fixing the fore part to the place to which they intend to move, then drawing the hinder part to it, and so on. Sometimes they turn round about upon one of the points of their tail; at other times they spring forwards with a jerk. When at rest they open their mouths very wide.

41. The *togata* has a convex body, filled with molecules, and of a dark colour; the hinder part somewhat broader than the forepart; the latter ciliated, and the tail formed of two very thin pellucid spines, which are somewhat curved, and much longer than the body.

42. The *rotatoria* is the *wheel animal* described by Mr Baker; and of which an account is given under the article ANIMALCULE.

43. The *furcata* is commonly found in water, and has a cylindric body with a rotatory organ, consisting of a row of hairs at the apex: the tail is divided into two parts, turning a little inwards. When at rest it joins the segments of the tail, but opens them when in motion.

44. The *catulus* is commonly found in marshy waters. It is a little thick muscular animalcule, folding itself up: equally broad throughout, the body disfigured by longitudinal folds, winding in various directions. The anterior part is connected to the body by a little neck; and it occasionally shows a small rotatory organ. Its motion is rotatory, but in various directions.

45. The *canicula* is cylindrical, the aperture plain, with a short articulated tail divided into two parts.

46. The *felis* has a large body, the apex of an equal thickness, obtuse, with rotatory filaments: the tail is acute, with two pellucid spines in length about one-third part of the body, alternately separating from and approaching one another.

47. The *stentorea*. See the article POLYPE.

48. The *socialis*, when considerably magnified, appears like a circle surrounded with crowns or ciliated heads, tied by small thin tails to a common centre, from whence they advance towards the circumference, where they turn very briskly, occasioning a kind of whirlpool, which brings in its food. When one of them has been in motion for a time, it stops and another begins; sometimes two or three may be perceived in motion at once: they are frequently to be met with separate, with the tail sticking in the mud. The body contracts and dilates very much, so as sometimes to have the appearance of a cudgel, at others to assume almost a globular form.

49. The *flosculosa* appears to the naked eye like a yellow globule adhering to the ceratophyllon like a little flower or a heap of yellow eggs. When magnified, they are seen to consist of a congeries of animalcula constituting a sphere from a mouldy centre. They contract and extend their bodies either alone or in society, and excite a vortex in the water by means of a disc. When they quit the society and act singly they may be observed to consist of a head, abdomen, and tail; the head being frequently drawn back into the abdomen so far that it cannot be seen, only exhibiting a broad kidney-shaped disc standing out. The abdomen is oblong, oval, and transparent; the tail sharp, twice as long as the abdomen, sometimes rough and annulated, or altogether smooth.

50. The *citrina* is found in stagnant water; the head full of molecules, round every where of an equal size, and very transparent. Both sides of the orifice are ciliated, and each has a rotatory motion appearing sometimes without and sometimes within the edge of the mouth.

51. The *piriformis* is somewhat oval, with a very small retractile foot, which it can draw within itself.

52. The *tuberosa* has a broad upper part, the under part small, with two projections at the anterior end, furnished with a number of fibrillæ, which produce a current of water by their vibration, and thus collect food for the animal.

53. The *ringens* is pear-shaped, pellucid, the middle of the aperture convex, both sides ciliated, the pedicle four times shorter than the body. It can contract the orifice to an obtuse point.

54. The *inclinans* has a pendulous, pellucid, little head; the anterior part truncated, and occasionally contracting itself twice as short as the pedicle. It is shaped like a tobacco-pipe.

55. The *vaginata* is erect, of the shape of a truncated egg; the pedicle is contained in a sheath.

56. The *globularia* is frequent among the cyclopa quadricorni. It has a small spherical head, the aperture of the mouth ciliated, the pedicle four times larger than the body, which it contracts into a spiral form.

57. The *lunaris* has a small goblet-shaped head, the margin of the orifice protuberant, ciliated on both sides, with undulating hairs, and the pedicle eight or ten times the length of the body. The pedicle extends itself as often as the mouth is opened, but is twisted up spirally when it is shut; and this is frequently repeated in a short space.

58. The *convallaria* is the same with the *bell-animal* mentioned by Mr Baker. See the article ANIMALCULE.

59. The *nutans* has a simple pedicle; twists itself spirally; is extremely slender, with a kind of cap on its head; the margin white and round, and seemingly encompassed with a lucid ring; the head diminishing towards the base.

60. The *nebulifera* is narrow at the base; open and truncated at the top; the margin seemingly surrounded with a ring: but, when the aperture is shut, the animalcule is of the shape of an egg, with a simple setaceous pedicle, considerably longer than the body and commonly much bent back.

61. The *annularis* is visible to the naked eye; the head an inverted cone, convex when the mouth is shut, but truncated when it is open; with a protuberant edge; the pedicle simple, very long, thick, and, whiter at the top than any where else; the apex twisted spirally. When contracted, it appears to be annulated.

62. The *acinosa* inhabits that whitish substance which often entirely covers plants, wood, shells, &c. When this substance is examined by a microscope, it appears to be wholly composed of living animals of the polype kind. See POLYPE.

63. The

63. The *fasciculata* has a rotatory organ, which may sometimes be seen projecting beyond the aperture; there is a little head at the apex, and the pedicle is twisted and very slender. A congealed green mass which is often found swimming about in ditches is composed of myriads of these animals, which are not visible to the naked eye, and when magnified appear like a bundle of green flowers.

64. The *hians* resembles a citron; the apex is truncated, the base narrow, and a gaping cleft is observable, descending from the apex to one third of the body.

65. The *bellis* is of a yellow colour, and much resembles the flower of a daisy; is ciliated round the margin of the head, and moves in a rotatory manner.

66. The *gemella* has a long pedicle, constantly furnished with two small heads.

68. The *pyraria*.
69. The *anastatica*. } See the article POLYPE.
70. The *digitalis*.

71. The *polypina*, when viewed through a small magnifier, they appear like so many little trees: the upper part, or heads, are egg-shaped, the top truncated, the lower part filled with intestines; the branches thick set with little knobs.

72. The *racemosa* is only distinguished from the vorticella socialis by always adhering to the sides of the vessel in which it is placed. By the microscope, we discover a long pedicle sticking to the sides of the vessels, from which proceed an innumerable quantity of crystalline pellucid pearls; which together with the stalk, are variously agitated in the water. Sometimes they move separately; sometimes they are drawn down to the root, and in a moment expanded again.

XVII. *Brachionus*:

A contractile worm, covered with a shell, and furnished with rotatory cilia.

1. The *striatus* has an oblong, pellucid shell, capable of altering its figure. The apex is truncated, with six small teeth on the edge of it, twelve longitudinal streaks down the back, the base obtuse and smooth. The teeth are occasionally protruded or retracted; and there are two small spines or horns on the other side of the shell. The animal itself is of a yellow colour, crystalline, and muscular; now and then putting out from the apex two or three little bundles of playing hairs, the two lateral ones shorter than that in the middle: on the under side we may observe a forked deglutatory muscle, and two rigid points when the apex is drawn in. It is found in sea-water.

2. The *squamula* has an univalve orbicular shell, a truncated apex, four teeth, smooth base, and no tail.

3. The *pala* is of a yellow colour; univalved, with an oblong excavated shell; four long teeth at the apex; a smooth base.

4. The *bipalium* is univalved, the shell oblong and inflected, ten teeth at the apex, the base smooth and a spurious tail.

5. The *patina* is extremely bright and splendid, has a large body, a crystalline and nearly circular shell, without either incision or teeth, only towards the apex it falls in so as to form a smooth notch. A double glittering organ, with ciliated edges, projects from the apex; both of them of a conical figure, and standing as it were upon a pellucid substance, which is divided into two lobes, between which and the rotatory organ there is a silver-coloured crenulated membrane. Two small claws may likewise be discovered near the mouth.

6. The *clypeatus* is univalved, the shell oblong, apex notched, the tail naked, and base smooth.

7. The *lamellaris* is univalved, the shell extending considerably beyond the body; the base divided into three small horns, with two hairs at the end of the tail.

8. The *patella* is found in marshy water in the winter-time. It is univalve, the shell oval, plain, crystalline, with the anterior part terminating in two acute points on both sides, though the intervening space is commonly filled up with the head of the animal. By these points it fastens itself, and whirls about the body erect. The rotatory cilia are perceived with great difficulty.

9. The *bractea* is univalved, the shell somewhat orbicular, apex lunated, base smooth, and the tail furnished with two spines.

10. The *plicatilis* is univalved, with an oblong shell the apex hairy, and base notched.

11. The *ovalis* is bivalved; the shell flattened, apex notched, a hollow part at the base, the tail formed of two tufts of hair.

12. The *tripos* is bivalved, the apex of the shell beardless, three horns at the base, and double tail. It fixes itself to the objects by the filaments of the tail.

13. The *dentatus* is bivalved, with an arched shell; the apex and base are both toothed, and the tail formed of two spines.

14. The *mucronatus* is bivalved, somewhat of a square form; the base and apex pointed; the tail consisting of two spines.

15. The *uncinatus* is one of the smallest bivalved animalcules; the apex and anterior part round, the hinder part straight terminating in a point, furnished with a hook on the fore part, a small rotatory organ, a long tail composed of joints, and divided at the end into two bristles. It can open its shell both at the fore and hind part.

16. The *cirratus* is larger than the preceding; ventricose, somewhat transparent, the head conical, with a bundle of hairs on both sides; and it has likewise a rotatory organ.

17. The *passus* has a cylindric shell, with two long pendulous locks of hair proceeding from the front, the tail consisting of a single bristle.

18. The *quadratus* has a quadrangular shell, with two small teeth at the apex, two horns proceeding from the base, and no tail.

19. The impressus has a quadrangular shell, a smooth undivided apex; obtuse base; notched margin; and flexuous tail.

20. The *urceolaris*. See POLYPE.

21. The *brachinus Bakeri* has a ventricose shell, four teeth at the apex, two horns at the base, and a long tail terminating in two short points. The horns are frequently extended; and the circular end of each is furnished with a tuft of little hairs, which sometimes move in a vibratory manner, at other times have a rotatory motion. Mr Muller has also discovered in this creature two small feelers and a tongue.

22. The *patulus* has a ventricose shell, with eight teeth.

teeth at the apex; the baſe lunated, or hollowed into the form of a creſcent, and furniſhed with four horns; the tail ſhort, with two ſmall points at the end.

These are the different kinds of animalcules which have yet been diſcovered. To what is ſaid of them in general under the article Animalcule, we ſhall here add the following obſervations from Mr Adams.—"How many kinds of theſe inviſibles there may be (ſays he), is yet unknown; as they are diſcerned of all ſizes, from thoſe which are barely inviſible to the naked eye, to ſuch as reſiſt the force of the microſcope as the fixed ſtars do that of the teleſcope, and with the greateſt powers hitherto invented appear only as ſo many moving points. The ſmalleſt living creatures our inſtruments can ſhow, are thoſe which inhabit the waters; for though animalcula equally minute may fly in the air, or creep upon the earth, it is ſcarce poſſible to get a view of them; but as water is tranſparent, by confining the creatures within it we can eaſily obſerve them by applying a drop of it to the glaſſes.

"Animalcules in general are obſerved to move in all directions with equal eaſe and rapidity, ſometimes obliquely, ſometimes ſtraight forward; ſometimes moving in a circular direction, or rolling upon one another, running backwards and forwards through the whole extent of the drop, as if diverting themſelves; at other times greedily attacking the little parcels of matter they meet with. Notwithſtanding their extreme minuteneſs, they know how to avoid obſtacles, or to prevent any interference with one another in their motions: ſometimes they will ſuddenly change the direction in which they move, and take an oppoſite one; and, by inclining the glaſs on which the drop of water is, as it can be made to move in any direction, ſo the animalcules appear to move as eaſily againſt the ſtream as with it. When the water begins to evaporate, they flock towards the place where the fluid is, and ſhow a great anxiety and uncommon agitation of the organs with which they draw in the water. Theſe motions grow languid as the water fails, and at laſt ceaſe altogether, without a poſſibility of renewal if they be left dry for a ſhort time. They ſuſtain a great degree of cold as well as inſects, and will periſh in much the ſame degree of heat that deſtroys inſects. Some animalcules are produced in water at the freezing point, and ſome inſects live in ſnow.—By mixing the leaſt drop of urine with the water in which they ſwim, they inſtantly fall into convulſions and die.

"The ſame rule ſeems to hold good in thoſe minute creatures, which is obſervable in the larger animals, *viz*, that the larger kinds are leſs numerous than ſuch as are ſmaller, while the ſmalleſt of all are found in ſuch multitudes, that there ſeem to be myriads for one of the others. They increaſe in ſize, like other animals, from their birth until they have attained their full growth; and when deprived of proper nouriſhment, they in like manner grow thin and periſh."

The modes of propagation among theſe animalcules are various, and the obſervation of them is extremely curious. Some multiply by a tranſverſe diviſion, as is obſerved under the article Animalcule: and it is remarkable, that though in general they avoid one another, it is not uncommon, when one is nearly divided, to ſee another puſh itſelf upon the ſmall neck which joins the two bodies in order to accelerate the ſepation.—Others, when about to multiply, fix themſelves to the bottom of the water; then becoming firſt oblong, and afterwards round, turn rapidly as on a centre, but perpetually varying the direction of their rotatory motion. In a little time, two lines forming a croſs are perceived; after which the ſpherule divides into four, which grow, and are again divided as before. A third kind multiply by a longitudinal diviſion, which in ſome begins in the fore-part, in others in the hind-part; and from others a ſmall fragment detaches itſelf, which in a ſhort time aſſumes the ſhape of the parent animalcule. Laſtly, others propagate in the ſame manner as the more perfect animals.

In our obſervations under the article Animalculf, we ſuggeſted ſome doubts whether all thoſe minute bodies which go under the name of *animalcules* really do enjoy animal life; or whether they are not in many caſes to be accounted only inanimate and exceedingly minute points of matter actuated by the internal motion of the fluid. This has alſo been the opinion of others: but to all hypotheſes of this kind Mr Adams makes the following reply. "From what has been ſaid, it clearly appears, that their motions are not purely mechanical, but are produced by an internal ſpontaneous principle; and that they muſt therefore be placed among the claſs of living animals, for they poſſeſs the ſtrongeſt marks and the moſt decided characters of animation; and, conſequently, that there is no foundation for the ſuppoſition of a chaotic and neutral kingdom, which can only have derived its origin from a very tranſient and ſuperficial view of theſe animalcules.—It may alſo be farther obſerved, that as we ſee that the motions of the limbs, &c. of the larger animals, are produced by the mechanical conſtruction of the body, and the action of the ſoul thereon, and are forced by the ocular demonſtration which ariſes from anatomical diſſection to acknowledge this mechaniſm which is adapted to produce the various motions neceſſary to the animal; and as, when we have recourſe to the microſcope, we find thoſe pieces which had appeared to the naked eye as the primary mechanical cauſes of particular motions, to conſiſt themſelves of leſſer parts, which are the cauſes of motion, extenſion, &c. in the larger; when the ſtructure therefore can be traced no farther by the eye, or by the glaſſes; we have no right to conclude that the parts which are inviſible are not equally the ſubject of mechaniſm: for this would be only to aſſert, in other words, that a thing may exiſt becauſe we ſee and feel it, and have no exiſtence when it is not the object of our ſenſes.—The ſame train of reaſoning may be applied to microſcopic inſects and animalcula: we ſee them move; but becauſe the muſcles and members which occaſion theſe motions are inviſible, ſhall we infer that they have not muſcles, with organs appropriated to the motion of the whole and its parts? To ſay that they exiſt not becauſe we cannot perceive them, would not be a rational concluſion. Our ſenſes are indeed given us that we may comprehend ſome effects; but then we have alſo a mind, with reaſon, beſtowed upon

Microscope upon us, that, from the things which we do perceive with our senses, we may deduce the nature of those causes and effects which are imperceptible to the corporeal eye.

Leaving these speculations however, we shall now proceed to give a particular

Explanation of the figures of the various animals, with their parts, ova, &c. represented in the plates.

Plate CCCII. Fig. 32. 33. represent the eggs of the phalæna neustria, as they are taken from the tree to which they adhere, and magnified by the microscope. The strong ground-work visible in many places shows the gum by which they are fastened together; and this connection is strengthened by a very tenacious substance interposed between the eggs, and filling up the vacant spaces. Fig. 34. shows a vertical section of the eggs, exhibiting their oval shape.—Fig. 35. is an horizontal section through the middle of the egg. These eggs make a beautiful appearance through the microscope. The small figures *a, b, c,* represent the objects in their natural state, without being magnified.

Fig. 36. shows the larva of the *musca chamæleon*, an aquatic insect. When viewed by the naked eye, it appears (as here represented) to be composed of twelve annular divisions, separating it into an head, thorax, and abdomen; but it is not easy to distinguish the two last parts from each other, as the intestines lie equally both in the thorax and abdomen. The tail is furnished with a fine crown or circle of hair *b*, disposed in the form of a ring, and by this means it is supported on the surface of the water, the head and body hanging down towards the bottom, in which posture it will sometimes remain for a considerable time without any motion.—When it has a mind to sink to the bottom, it closes the hairs of the ring, as in fig. 37. Thus an hollow space is formed, including a small bubble of air; by enlarging or diminishing which, it can rise or sink in the water at pleasure. When the bubble escapes, the insect can replace it from the pulmonary tubes, and sometimes considerable quantities of air may be seen to escape from the tail of the worm into the common atmosphere; which operation may easily be observed when the worm is placed in a glass of water, and affords an entertaining spectacle. The snout of this insect is divided into three parts, of which that in the middle is immoveable; the other two, which grow from the sides of the middle one, are moveable, and vibrate like the tongues of lizards or serpents. In these lateral parts lies most of the creature's strength; for it walks upon them when out of the water, appearing to walk on its mouth, and to use it as the parrot does its beak to assist it in climbing.

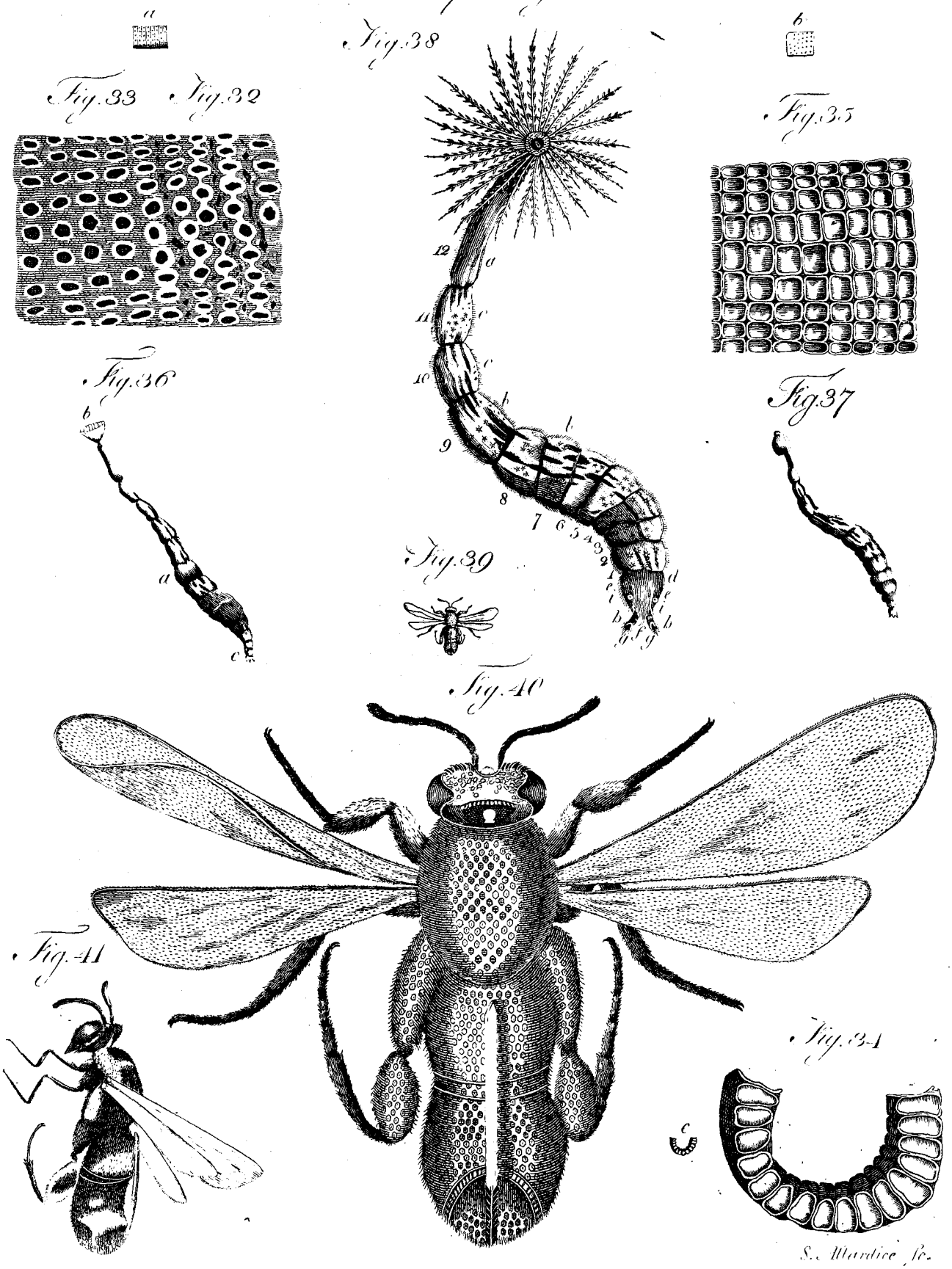
The larva is shown fig. 38. as it appears through a microscope. It grows narrower towards the head, is largest about that part which we may call the thorax, converges all along the abdomen, and terminates at length in a sharp tail surrounded with hairs, as has already been mentioned. The twelve annular divisions are now extremely visible, and are marked by numbers in the plate. The skin appears somewhat hard, and resembling shagreen, being thick set with grains pretty equally distributed. It has nine holes, or spiracula, probably for the purpose of breathing, on each side; but it has none of these on the tail division *a*, nor any easily visible on the third from the head. In the latter, indeed, it has some very small holes concealed under the skin, near the place where the embryo wings of the future fly are hid. "It is remarkable (says Mr Adams) that caterpillars, in general, have two rings without these spiracula, perhaps because they change into flies with four wings, whereas this worm produces a fly with only two. The skin of the larva is adorned with oblong black furrows, spots of a light colour, and orbicular rings, from which there generally springs a hair; but only those hairs which grow on the insect's sides are represented in the figure. There are also some larger hairs here and there, as at *c c*. The difference of colour, however, in this worm arises only from the quantity of grains in the same space; for where they are in very great numbers, the furrows are darker, and paler where they are less plentiful.

The head *d* is divided into three parts, and covered with a skin which has hardly any discernible grains.—The eyes are rather protuberant, and lie near the snout; on which last are two small horns at *i i*. It is crooked, and ends in a sharp point as at *f*. The legs are placed near the snout between the sinuses in which the eyes are fixed. Each of these legs consists of three joints, the outermost of which is covered with stiff hairs like bristles *g g*. From the next joint there springs a horny bone *h h*, used by the insect as a kind of thumb: the joint is also composed of a black substance of an intermediate hardness between bone and horn; and the third joint is of the same nature. In order to distinguish these parts, those that form the upper sides of the mouth and eyes must be separated by means of a small knife; after which, by the assistance of the microscope, we may perceive that the leg is articulated by some particular ligaments, with the portion of the insect's mouth which answers to the lower jaw in the human frame. We may then also discern the muscles which serve to move the legs, and draw them up into a cavity that lies between the snout and those parts of the mouth which are near the horns *i i*. The insect walks upon these legs, not only in the water, but on the land also. It likewise makes use of them in swimming, keeping its tail on the surface contiguous to the air, and hanging downward with the rest of the body in the water. In this situation, the only perceptible motion it has is in its legs, which it moves in a most elegant manner, from whence it is reasonable to conclude, that the most of this creature's strength lies in its legs, as we have already observed.

The snout of this larva is black and hard: the back part quite solid, and somewhat of a globular form; the front *f* sharp and hollow. Three membranaceous divisions may be perceived on the back part; by means of which, and the muscles contained in the snout, the creature can contract or expand it at pleasure.

The extremity of the tail is surrounded with thirty hairs, and the sides adorned with others that are smaller; and here and there the large hairs branch out into smaller ones, which may be reckoned single hairs. All these have their roots in the outer skin, which in this place is covered with rough grains, as may be observed by cutting it off and holding it against the light upon

Microscopic Objects



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Microscope upon a slip of glass. Thus also we find, that at the extremities of the hairs there are grains like those on the skin; and in the middle of the tail there is a small opening, within which are minute holes, by which the insect takes in and lets out the air it breathes. These hairs, however, are seldom disposed in such a regular order as is represented in fig. 38. unless when the insect floats with the body in the water, and the tail with its hairs a little lower than the surface, in which case they are disposed exactly in the order delineated in the plate. The least motion of the tail downward produces a concavity in the water; and it then assumes the figure of a wine-glass, wide at the top and narrow at the bottom. The tail answers the double purpose of swimming and breathing, and through it the insect receives what is the principle of life and motion to all animals. By means of these hairs also it can stop its motion when swimming, and remain suspended quietly without motion for any length of time. Its motions in swimming are very beautiful, especially when it advances with its whole body floating on the surface of the water after filling itself with air by the tail.—To set out, it first bends the body to the right or left, and then contracts it in the form of the letter S, and again stretches it out in a straight line: by thus contracting and then extending the body alternately, it moves on the surface of the water. It is very quiet and is not disturbed by handling.

These creatures are commonly found in shallow standing waters in the beginning of June; but some years much more plentifully than others. They crawl on the grass and other plants which grow in such waters, and are often met with in ditches floating on the surface of the water by means of their tail, the head and thorax at the same time hanging down; and in this posture they turn over the clay and dirt with their snout and feet in search of food, which is commonly a viscous matter met with in small ponds and ditches. It is very harmless, though its appearance would seem to indicate the contrary. It is most easily killed for dissection by spirit of turpentine.

Fig. 39. shows in its natural size a beautiful insect, described by Linnæus under the name of *Leucopsis dorsigera*, and which appears to be a kind of intermediate genus between a sphex and a wasp. The antennæ are black and cylindrical, increasing in thickness towards the extremity; the joint nearest the head is yellow; the head and thorax are black, encompassed with a yellow line, and furnished with a cross line of the same colour near the head. The scutellum is yellow, the abdomen black, with two yellow bands, and a deep spot of the same colour on each side between the bands. A deep polished groove extends down the back from the thorax to the anus, into which the sting turns and is deposited, leaving the anus very circular; a yellow line runs on each side of the sting.—The anus and whole body, when viewed with a small magnifier, appear punctuated; but when these points are seen through a large magnifier, they appear hexagonal. Fig. 40. shows the insect very much magnified. Fig. 41. gives a side view of it magnified in a smaller degree.

Fig. 42. shows an insect lately discovered by Mr John Adams of Edmonton, as he happened to be at an inn. It was first seen by some labouring people who were there at the time, by whom it was conjectured to be a louse with unusually long horns, a mite, &c. Mr Adams hearing the debate, procured the insect; and having viewed it through a microscope, it presented the appearance exhibited in fig. 42. The insect seems to be quite distinct from the phalangium cancroides of Linnæus. The latter has been described by several authors, but none of their descriptions agree with this. The abdomen of this insect is more extended, the claws larger, and much more obtuse; the body of the other being nearly orbicular, the claws slender, and almost terminating in a point, more transparent, and of a paler colour. Mr Marsham has one in his possession not to be distinguished from that represented in fig. 42, excepting only that it wants the break or dent in the claws, which is so conspicuous in this. He found that insect firmly fixed by its claws to the thigh of a large fly, which he caught on a flower in Essex in the first week of August, and from which he could not disengage it without great difficulty, and tearing off the leg of the fly. This was done upon a piece of writing paper; and he was surprised to see the little creature spring forward a quarter of an inch, and again seize the thigh with its claws, so that he had great difficulty in disengaging it. The natural size of this creature, which Mr Adams calls the *lobster-insect*, is exhibited at *a*. Plate CCCIII.

Fig. 43. shows the insect named by M. de Geer *Physapus*, on account of the bladders at its feet, (*Thrips physapus*, Lin.). This insect is to be found in great plenty upon the flowers of dandelion, &c. in the spring and summer. It has four wings two upper and two under ones (represented fig. 44.) but the two undermost are not to be perceived without great difficulty. They are very long; and fixed to the upper part of the breast, lying horizontally. Both of them are rather pointed towards the edges, and have a strong nerve running round them, which is set with a hair fringe tufted at the extremity. The colour of these wings is whitish: the body of the insect is black; the head small, with two large reticular eyes. The antennæ are of an equal size throughout, and divided into six oval pieces, which are articulated together.—The extremities of the feet are furnished with a membranaceous and flexible bladder, which it can throw out or draw in at pleasure. It presses this bladder against the substances on which it walks, and thus seems to fix itself to them; the bladder sometimes appears concave towards the bottom, the concavity diminishing as it is less pressed. The insect is represented of its natural size at *b*.

Fig. 45. represents the *Cimex striates* of Linnæus, remarkable for very bright and elegantly disposed colours, though few in number. The head, proboscis, and thorax, are black: the thorax ornamented with yellow spots; the middle one large, and occupying almost one-third of the posterior part; the other two are on each side, and triangular. The scutellum has two yellow oblong spots, pointed at each end. The ground of the elytra is a bright yellow, spotted and striped with black. The nerves are yellow; and there is a brilliant triangular spot of orange, which unites the crustaceous and membrana-

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ceous parts; the latter are brown, and clouded. It is found on the elm-tree in June. It is repreſented of its natural ſize at *c*.

Fig. 46. ſhows the *Chryſomela aſparagi* of Linnæus, ſo called from the larva of the inſect feeding upon that plant. It is a common inſect, and very beautiful. It is of an oblong figure, with black antennæ, compoſed of many joints, nearly oval. The head is a deep and bright blue; the thorax red and cylindrical: the elytra are blue, with a yellow margin, and having three ſpots of the ſame colour on each; one at the baſe, of an oblong form, and two united with the margin: the legs are black; but the under ſide of the belly is of the ſame blue colour with the elytra and head. This little animal when viewed by the naked eye, ſcarcely appears to deſerve any notice; but when examined by the microſcope, is one of the moſt pleaſing opaque objects we have. It is found in June on the aſparagus after it has run to ſeed; and is ſhown of its natural ſize at *d*. De Geer ſays that it is very ſcarce in Sweden.

Fig. 47. ſhows an inſect of a ſhape ſo remarkable, that naturaliſts have been at a loſs to determine the genus to which it belongs. In the Fauna Suecica, Linnæus makes it an *attelabus*: but in the laſt edition of the Syſtema Naturæ, it is ranged as a meloe, under the title of the *Meloe monoceros*; though of this alſo there ſeems to be ſome doubt. The true figure of it can only be diſcovered by a very good microſcope. The head is black, and appears to be hid or buried under the thorax, which projects forward like a horn: the antennæ are compoſed of many joints, and are of a dirty yellow colour, as well as the feet: the hinder part of the thorax is reddiſh, the fore part black.—The elytra are yellow, with a black longitudinal line down the ſuture; there is a band of the ſame colour near the apex, and alſo a black point near the baſe, the whole animal being curiouſly covered with hair. The natural ſize of it is ſhown at *e*. It was found in May. Geoffroy ſays that it lives upon umbelliferous plants.

Fig. 48—53. exhibit the anatomy of the coſſus caterpillar, which lives on the willow. The egg from which it proceeds is attached to the trunk of the tree by a kind of viſcous juice which ſoon becomes ſo hard that the rain cannot diſſolve it. The egg itſelf is very ſmall and ſpheroidal, and, when examined by the microſcope, appears to have broad waving furrows running through the whole length of it, which are again croſſed by cloſe ſtreaks, giving it the appearance of a wicker baſket. It is not exactly known what time they are hatched; but as the ſmall caterpillars appear in September, its is probable that the eggs are hatched ſome time in Auguſt. When ſmall, they are generally met with under the bark of the tree to which the eggs were affixed; and an aqueous moiſture, oozing from the hole through which they got under the bark is frequently though not always, a direction for finding them. Theſe caterpillars change their colour but very little, being nearly the ſame when young as when old. Like many others they are capable of ſpinning as ſoon as they come from the egg. They alſo change their ſkin ſeveral times; but as it is almoſt impoſſible to rear them under a glaſs, ſo it is very difficult to know exactly how often this moulting takes place.—Mr Adams conjectures that it is more frequently than the generality of caterpilars do, ſome having been obſerved to change more than nine times.

The coſſus generally faſts for ſome days previous to the moulting; during which time the fleſhy and other interior parts of the head are detached from the old ſkull, and retire as it were within the neck. The new coverings ſoon grow on, but are firſt very ſoft.—When the new ſkin and the other parts are formed, the old ſkin is to be opened, and all the members withdrawn from it; an operation naturally difficult, but which muſt be rendered more ſo from the ſoft and weak ſtate of the creature at that time. It is always much larger after each change,

From Mr Lyonet's experiments, is appears that the coſſus generally paſſes at leaſt two winters, if not three before it aſſumes the pupa ſtate. At the approach of winter, it forms a little caſe, the inſide of which is lined with ſilk, and the outſide covered with wood ground like very fine ſaw-duſt. During the whole ſeaſon it neither moves nor eats,

This caterpillar, at its firſt appearance, is not above one-twelfth of an inch long; but at laſt attains the length of two, and ſometimes of three inches. In the month of May it prepares for the pupa ſtate; the firſt care being to find a hole in the tree ſufficient to allow the moth to iſſue forth and if this cannot be found, it makes one equal in ſize to the future pupa. It then begins to form of wood a caſe or cone; uniting the bits, which are very thin, together by ſilk, into the form of an ellipſoid, the outſide being formed of ſmall bits of wood joined together in all directions; taking care, however, that the pointed end of the caſe may always be oppoſite to the mouth of the hole: having finiſhed the outſide of the caſe, it lines the inſide with a ſilken tapeſtry of a cloſe texture in all its parts, except the pointed end, where the texture is looſer, in order to facilitate its eſcape at the proper time. The caterpillar then places itſelf in ſuch a poſture, that the head may always lie towards the opening of the hole in the tree or pointed end of its caſe. Thus it remains at reſt for ſome time: the colour of the ſkin firſt becomes pale, and afterwards brown; the interior parts of the head are detached from the ſkull; the legs withdraw themſelves from the exterior caſe; the body ſhortens; the poſterior part grows ſmall, while the anterior part ſwells ſo much, that the ſkin at laſt burſts; and, by a variety of motions, is puſhed down to the tail; and thus the pupa is exhibited, in which the parts of the future moth may be eaſily traced.—The covering of the pupa, though at firſt ſoft, humid, and white, ſoon dries and hardens, and becomes of a dark purple colour: the poſterior part is moveable; but not the fore-part, which contains the rudiments of the head, legs, and wings. The fore-part of the pupa is furniſhed with two horns, one above and the other under the eyes. It has alſo ſeveral rows of points on its back. It remains for ſome weeks in the caſe; after which the moth begins to agitate itſelf, and the points are then of eſſential ſervice, by acting as a fulcrum, upon which it may reſt in its endeavours to proceed forward, and not ſlip back by its efforts for that purpoſe.

The moth generally continues its endeavours to open the caſe for a quarter of an hour; after which, by redoubled efforts, it enlarges the hole, and preſſes forward

ward until it arrives at the edge, where it makes a full ſtop, leſt by advancing further it ſhould fall to the ground. After having in this manner repoſed itſelf for ſome time, it begins to diſengage itſelf entirely; and having reſted for ſome hours with its head upwards, it becomes fit for action. Mr Marſham ſays, that it generally puſhes one third of the caſe out of the hole before it halts.

The body of the caterpillar is divided into twelve rings, marked 1, 2, 3, &c. as repreſented in fig. 48. 49. 50. 51. each of which is diſtinguiſhed from that which precedes, and that which follows, by a kind of neck or hollow; and, by forming boundaries to the rings, we make twelve other diviſions, likewiſe expreſſed in the figures; but to the firſt of theſe the word *ring* is affixed, and to the ſecond, *diviſion*. To facilitate the deſcription of this animal, M. Lyonet ſuppoſed a line to paſs down through the middle of the back, which he called the ſuperior line, becauſe it marked the moſt elevated part of the back of the caterpillar; and another, paſſing from the head down the belly to the tail, he called the inferior line.

All caterpillars have a ſmall organ, reſembling an elliptic ſpot, on the right and left of each ring, excepting the ſecond, third, and laſt; and by theſe we are furniſhed with a further ſubdiviſion of this caterpillar, viz. by lines paſſing through the ſpiracula, the one on the right ſide, the other on the left of the caterpillar. Theſe four lines, which divide the caterpillar longitudinally into four equal parts, mark each the place under the ſkin which is occupied by a conſiderable viſcus. Under the ſuperior line lies the heart, or rather thread of hearts; over the inferior line, the ſpinal marrow; and the two tracheal arteries follow the courſe of the lateral lines. At equal diſtances from the ſuperior and two lateral lines, we may ſuppoſe four intermediate lines. The two between the ſuperior and lateral lines are called the intermediate ſuperior; the two others oppoſite to them, and between the lateral and inferior lines, are called the intermediate inferior.

Fig. 48. 49. ſhow the muſcles of the caterpillar, arranged with the moſt wonderful ſymmetry and order, eſpecially when taken off by equal ſtrata on both ſides, which exhibits an aſtoniſhing and exact form and correſpondence in them. The figures ſhow the muſcles of two different caterpillars opened at the belly, and ſuppoſed to be joined together at the ſuperior lines. The muſcles of the back are marked by capitals; the gaſtric muſcles by Roman letters; the lateral ones by Greek characters. Thoſe marked θ are called, by M. Lyonet, dividing muſcles, on account of their ſituation.

The caterpillar was prepared for diſſection by being emptied, and the muſcles, nerves, &c. freed from the fat in the manner formerly directed: after which the following obſervations were made.

The muſcle A in the firſt ring is double; the anterior one being thick at top, and being apparently divided into different muſcles on the upper ſide, but without any appearance of this kind on the under ſide. One inſertion is at the ſkin of the neck towards the head; the other is a little above; and that of the ſecond muſcle A is a little below the firſt ſpiraculum, near which they are fixed to the ſkin.

The muſcle marked α is long and ſlender, fixed by its anterior extremity under the gaſtric muſcles *a* and *b* of the firſt ring, to the circumflex ſcale of the baſe of the lower lip. It communicates with the muſcle *c* of the ſecond ring, after having paſſed under ſome of the arteries, and introduced itſelf below the muſcle θ.

The muſcle β is ſo tender, that it is ſcarce poſſible to open the belly of the caterpillar without breaking it. It is ſometimes double, and ſometimes triple.—Anteriorly it is fixed to the poſterior edge of the ſide of the parietal ſcale, the lower fixture being at the middle of the ring near the inferior line.

There are three muſcles marked ξ; the firſt affixed at one extremity near the lower edge of the upper part of the parietal ſcale; the other end divides itſelf into three or four tails, fixed to the ſkin of the caterpillar under the muſcle δ. The anterior part of the ſecond is fixed near the firſt; the anterior part of the third a little under the firſt and ſecond, at the ſkin of the neck under the muſcle A. Theſe two laſt paſſing over the cavity of the firſt pair of limbs, are fixed by ſeveral tails to the edge oppoſite to this cavity. In this ſubject there are two muſcles marked δ, but ſometimes there is only one anteriorly; they are fixed to the lower edge of the parietal ſcale, the other ends being inſerted in the firſt fold of the ſkin of the neck on the belly-ſide. Fig. 50. beſt repreſents the muſcles β and δ; as in that figure they do not appear injured by any unnatural connection.

In the ſecond and four following rings we diſcern two large dorſal muſcles A and B. In the 7th, 9th, and 10th rings are three, A, B, and C; in the 11th are four, A, B, C, and D; and in the anterior part of the 12th ring are five, A, B, C, D, and E. All theſe ranges of muſcles, however, as well as the gaſtric muſcles *a*, *b*, *c*, *d*, appear at firſt ſight only as a ſingle muſcle, running nearly the whole length of the caterpillar; but when this is detached from the animal, it is found to conſiſt of ſo many diſtinct muſcles, each conſiſting only of the length of one of the rings, their extremities being fixed to the diviſion of each ring, excepting the middle muſcle *a*, which, at the 6th, 7th, 8th, and 9th rings, has its inſertions rather beyond the diviſion. Each row of muſcles appears as one, becauſe they are cloſely connected at top by ſome of the fibres which paſs from one ring to the other.

The muſcles A, which are 12 in number, gradually diminiſh in breadth to the lower part of the laſt ring: at the 8th and three following diviſions they communicate with the muſcles B, and at the 11th with D. In the lower part of the laſt ring, A is much broader than it was in the preceding ring; one extremity of it is contracted, and communicates with B; the lower inſertion being at the membrane I, which is the exterior ſkin of the fecal bag. The muſcles A and B, on the lower part of the laſt ring, cannot be ſeen until a large muſcle is removed, which on one ſide is fixed to the ſubdiviſion of the ring and on the other to the fecal bag.

The right muſcles B, which are alſo 12 in number, begin at the ſecond ring, and grow larger from thence to the ſeventh. They are uſually narrower from thence to the 12th; the deficiency in width be-

ing supplied by the six muscles C, which accompany it from the 7th to the subdivision of the 12th ring. The muscles B and C communicate laterally with the 8th, 11th, and 12th divisions. C is wanting at the subdivision of the 12th; its place being here supplied by B, which becomes broader at this part.

The first of the three floating muscles V originates at the first ring, from whence it introduces itself under N, where it is fixed, and then subdivides, and hides itself under other parts. The second begins at the second division, being fixed to the anterior extremity of B of the second ring; from thence directing itself towards the stomach; and, after communicating with the case of the *corpus crassum*, it divides, and spreads into eight muscles which run along the belly. The third begins at the third division, originating partly at the skin, and partly at the junction of the muscles B of the second and third ring. It directs itself obliquely towards the belly, meeting it near the third spiraculum; and branching from thence, it forms the oblique muscles of some of the viscera.

The thin, long, muscle θ, which is at the subdivision of the last ring, and covers the anterior insertion of the muscle (*a*) where the ring terminates, is single. It begins at one extremity of the muscle (*c*); at the fore-part of the ring runs along the subdivision round the belly of the caterpillar, and finishes, on the other side, at the extremity of a similar muscle C.

Fig. 49. shows the dorsal muscles of the cossus. To view which in an advantageous manner, we must use the following mode of preparation.

1. All the dorsal muscles, 35 in number, must be taken out, as well as the seven lateral ones already described.

2. All the straight muscles of the belly must be taken away, as well as the muscular roots (*c*), and the ends of the gastric muscles (*c*), which are at the third and fourth divisions.

3. At the second division the muscle θ must be removed; only the extremities being left to show where it was inserted.

The parts being thus prepared, we begin at the third ring; where there are found four dorsal muscles C, D, E, and F. The first one C, is inserted at the third division, under the muscles θ and α, where it communicates by means of some fibres with the muscle *f* of the second ring; proceeding from thence obliquely towards the intermediate superior line, and is fixed at the fourth division. As soon as C is retrenched, the muscle D is seen; which grows wider from the anterior extremity: it lies in a contrary direction to the muscle C, and is inserted into the third and fourth divisions. The muscle E lies in the same direction as the muscle C, but not so obliquely: the lower insertion is at the fourth division; the other at the third, immediately under C. The muscle F is nearly parallel to D which joins it; the first insertion is visible, but the other is hid under the muscles E and G at the fourth division.

In the eight following rings, there are only two dorsal muscles; and of these D is the only one that is completely seen. It is very large, and diminishes gradually in breadth from one ring to the other, till it comes to the last, sending off branches in some places.---E is one of the strait muscles of the back; and is inserted under the dividing muscles θ, at the divisions of its own ring.

On the anterior part of the 12th ring there are three dorsal muscles, D, E, and F. D is similar to that of the preceding ring, marked also D, only that it is no more than half the length; terminating at the subdivision of its own ring. E is of the same length, and differs from the muscle E of the preceding ring only in its direction. F is parallel to E, and shorter than it; its anterior end does not reach the twelfth division.

On the posterior part there is only one dorsal muscle, fastened by some short ones to the subdivision of the last ring, traversing the muscles α; and being fixed there as if designed to strengthen them, and to vary their direction.---α is a single muscle, of which the anterior insertion is visible, the other end being fixed to the bottom of the foot of the last leg; its use is to move the foot. The anterior part of the muscle β branches into three or four heads, which cross the superior line obliquely, and are fixed to the skin a little above it. The other end is fastened to the membrane T.

Fig. 50. and 51. show the muscles of the caterpillar when it is opened at the back. The preparation for this view is to disengage the fat and other extraneous matter, as before directed.

The first ring has only two gastric muscles (*c*) and (*d*): the former is broad, and has three or four little tails: the first fixture is at the base of the lower lip, from whence it descends obliquely, and is fixed between the inferior and lateral line. The small muscle (*d*) is fastened on one side to the first spiraculum; on the other, a little lower, to the intermediate inferior and lateral line; and seems to be an antagonist to the muscle P, which opens the spiracula. The posterior fixture of δ is under the muscle C, near the skin of the neck: β is fixed a little on the other side of C, at the middle of the ring.

In the second ring there are three gastric muscles, *g*, *h*, and *i*: *g* and *h* are fixed at the folds which terminate the ring; but only the anterior part of *i* is fixed there. The muscle *h* is triple, and in one of the divisions separated into two parts; that marked *i* comes nearer the inferior line, and is fixed a little beyond the middle of the ring, where the corresponding muscle of the opposite side is forked to receive it.

In the third ring, the muscle *h*, which was triple in the foregoing ring, is only double here, that part which is nearest the inferior line being broadest: it has three tails, of which only two are visible in the figure. It is exactly similar to that of the preceding ring; and is crossed in the same manner by the muscle from the opposite side of the ring.

Throughout the eight following rings, the muscle *f* which runs through them all is very broad and strong. The anterior part of it is fixed at the intermediate inferior line, on the fold of the first division of the ring: the other part is fixed beyond the lower division; with this difference, that at the 10th and 11th rings it is fixed at the last fold of its ring; whereas, in the others it passes over that ring, and is inserted into the skin of the following one. In all these,

Plate CCCIII

Microscopic Objects.

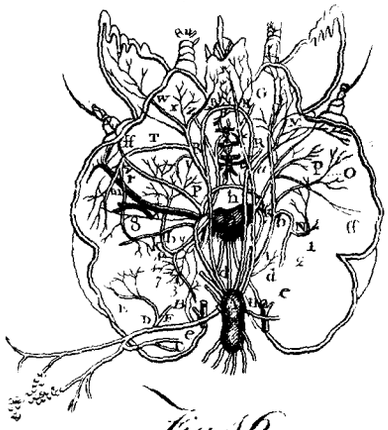


Fig. 21.

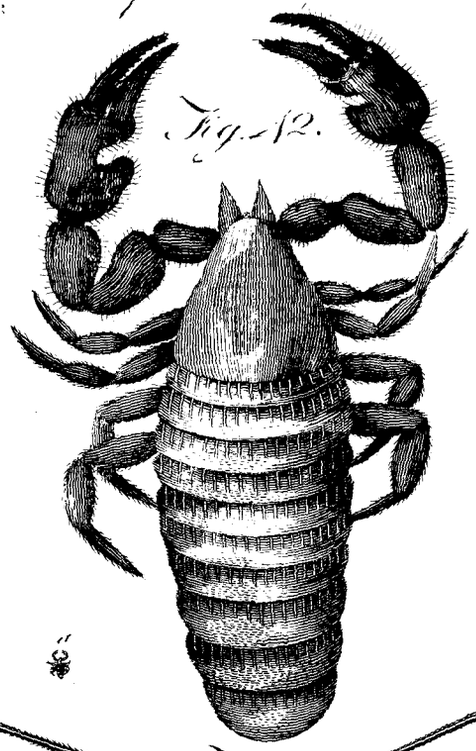


Fig. 42.

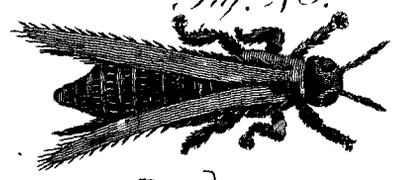


Fig. 43.

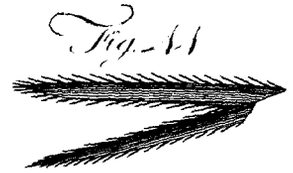
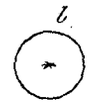


Fig. 44



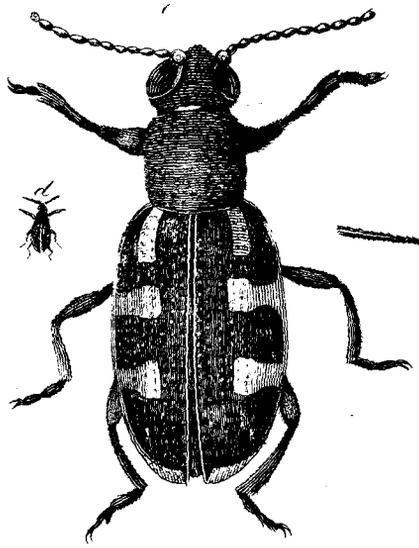


Fig. 46.

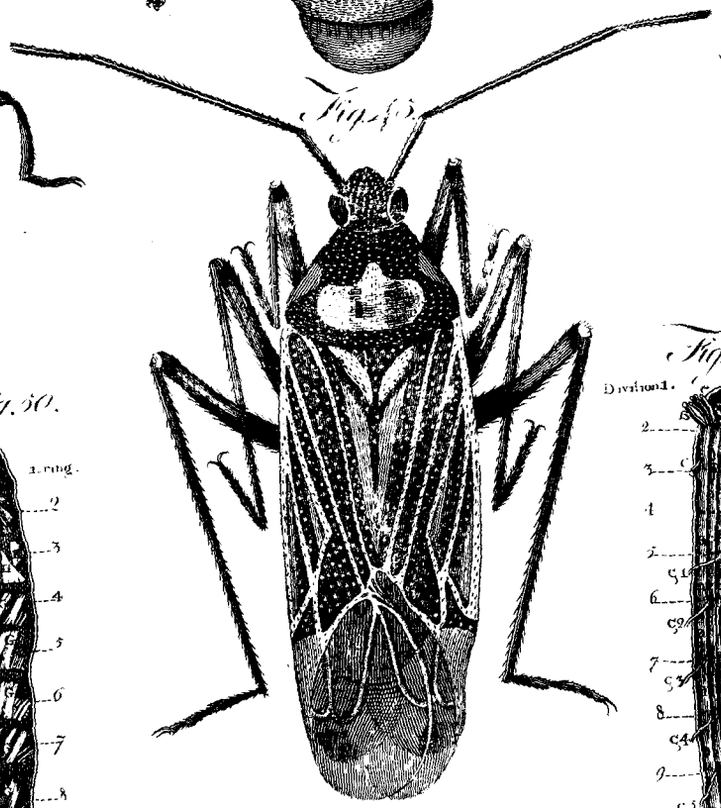


Fig. 45.

Fig. 53. Fig. 52.

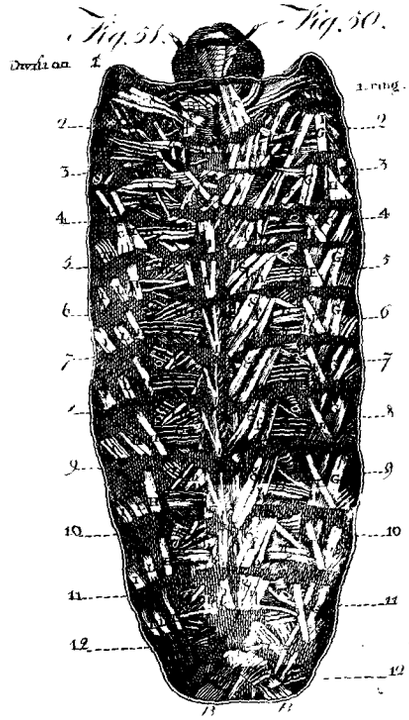


Fig. 51. Fig. 50.

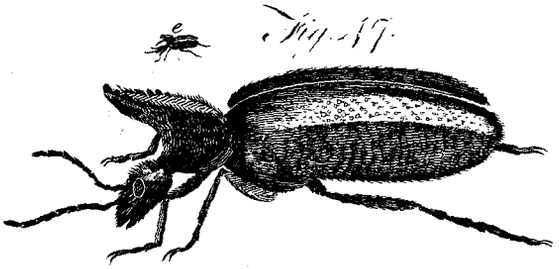


Fig. 47.

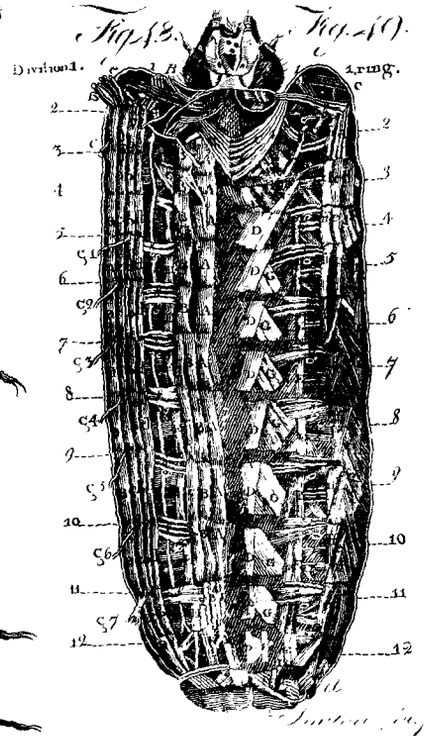


Fig. 48. Fig. 49.

Microſcope

theſe, the firſt extremity of the muſcle *g* is faſtened to the fold which ſeparates the ring from the preceding one, and is parallel to *f*, and placed at the ſide of it. The ſix firſt muſcles marked *g*, are forked; that of the fourth ring being more ſo than the reſt, nor does it unite till near its anterior inſertion. The longeſt tail lays hold of the following, and is inſerted near the inferior line; the other inſerts itſelf near the ſame line, at about the middle of its own ring. The two laſt do not branch out; but terminate at the diviſions, without reaching the following ring. The muſcle *h*, placed at the ſide of *f*, has nearly the ſame direction, and finiſhes at the folds of the ring.

The anterior part of the 12th ring has only one gaſtric muſcle, marked *e*: it is placed on the intermediate inferior line; and is inſerted at the folds of the upper diviſion, and at the ſubdiviſion of this ring. The lower part has a larger muſcle marked *c*, with ſeveral diviſions; one placed under *b*, with one extremity fixed near the lateral line, at the ſubdiviſion of its ring; the other to the fecal bag, a little lower than the muſcle *b*.

In fig. 51. all the gaſtric muſcles deſcribed in fig. 50. diſappear, as well as thoſe lateral and dorſal ones of which the letters are not to be found in this figure.

In the firſt ring are the gaſtric muſcles, *e*, *f*, *g*, which are beſt ſeen here: the firſt is narrow and long, paſſing under and croſſing *f*: one of its inſertions is at the lower line, the other at the lateral, between the ſpiraculum and neck: *f* is ſhort, broad, and nearly ſtraight, placed along the intermediate line; but between it and the lateral it paſſes under *e*, and is fixed to the fold of the ſkin which goes from the one bag to the other; the lower inſertion is near the ſecond diviſion. There are ſometimes three muſcles of thoſe marked *g*, and ſometimes four: the lower parts of them are fixed about the middle of the ring, and the anterior parts at the fold of the ſkin near the neck. The muſcles *i* and *h* are fixed to the ſame fold; the other end of *h* being fixed under the muſcle π, near the ſpiraculum. Above the upper end of *f*, a muſcular body, *g*, may be ſeen. It is formed by the ſeparation of two floating muſcles.

The ſecond ring has ſix gaſtric muſcles, *k*, *l*, *m*, *n*, *o*, *p*. The firſt is a large oblique muſcle, with three or four diviſions placed at the anterior part of the ring: the head is fixed between the inferior line and its intermediate one, at the fold of the ſecond diviſion; from whence it croſſes the inferior line and its correſponding muſcle, terminating to the right and left of the line. I is a narrow muſcle, whoſe head is fixed to the fold of the ſecond diviſion; the tail of it lying under *n*, and faſtened to the edge of the ſkin that forms the cavity for the leg. The two muſcles marked *m* have the ſame obliquity, and are placed the one on the other: the head is inſerted in the ſkin under the muſcle β, and communicates by a number of fibres with the tail of the muſcle χ, the other end is fixed to the intermediate inferior line at the fold of the third diviſion. The large and broad muſcle *n*, covers the lower edge of the cavity of the limb, and the extremity of the tail of *l*. It is fixed firſt at the ſkin, near the intermediate line, from whence it goes in a perpendicular direction towards *m*, and introduces itſelf under *o* and *m*, where it is fixed. The muſcle *o* is narrow and bent, and covers the edge of the cavity of the leg for a little way; one end terminating there, and the other finiſhing at the third diviſion near *m*. That marked *p* is alſo bent: it runs near the anterior edge of the cavity of the leg; one end meets the head of *o*, the other end terminates at a raiſed fold near the inferior line. There is a triangular muſcle on the ſide of the lateral muſcle *o*, ſimilar to that marked *g* in the following ring: in this figure it is entirely concealed by the muſcle *m*.

The third ring has no muſcle ſimilar to *m*; that marked *k* differs only from that of the ſecond ring in being croſſed by the oppoſite muſcle. Thoſe marked *l*, *n*, *o*, *p*, are ſimilar to thoſe of the preceding one. The muſcle *q* is triangular; the baſe is faſtened to the laſt fold of the ring; on the lower ſide it is fixed to the muſcle *o*, the top to the ſkin at the edge of the cavity for the leg.

The eight following rings have the gaſtric muſcles, *i*, *k*, *l*, and *m*. The muſcle *i* is quite ſtraight, and placed at ſome diſtance from the inferior line: it is broad at the fourth ring, but diminiſhes gradually in breadth to the 11th. In the fourth it is united; but divides into two heads, which divaricate in the following rings. In the ſix next rings theſe heads are fixed nearly at the ſame place with *a* and *f*; and in the other two it terminates at the fold of the ring. The anterior inſertion of the firſt and laſt is at the fold where the ring begins: that of the ſix others is ſomewhat lower under the place where the muſcle *i* terminates. The lower part of the oblique muſcle *k* is inſerted in the ſkin near *i*; the upper part at the intermediate inferior muſcle upon the fold which ſeparates the following ring, but is wanting in the 11th. The muſcle *l* is large and co-operates with M: in the opening and ſhutting the ſpiraculum, one of its fixtures is near the intermediate inferior line, at about the ſame height as *i*. The tail terminates a little below the ſpiraculum.

The twelfth ring has only the ſingle gaſtric muſcle *d*, which is a bundle of ſix, ſeven, or eight muſcles: the firſt fixture of theſe is at the ſubdiviſion of the ring near the inferior line: one or two croſs this, and at the ſame time the ſimilar muſcles of the oppoſite ſide. Their fixture is at the bottom of the foot; and their office is to aſſiſt the muſcle *a* in bringing back the foot, and to looſen the claw from what it lays hold of. One of the inſertions of this muſcle *a* is obſerved in this figure near *d*, the other near the ſubdiviſion of the ring.

Fig. 52. and 53. ſhow the organization of the head of the coſſus, though in a very imperfect manner, as M. Lyonet found it neceſſary to employ *twenty* figures to explain it fully. The head is repreſented as it appears when ſeparated from the fat, and diſengaged from the neck. HH are the two palpi. The truncated muſcles D belong to the lower lip, and aſſiſt in moving it. K ſhows the two ganglions of the neck united. II are the two veſſels which aſſiſt in ſpinning the ſilk. L, the œſophagus. M, the two diſſolving veſſels. The Hebrew characters רכבא ſhow the continuation of the four cephalic arteries. In fig. 52. the ten abductor muſcles of the jaw

are repreſented by SS, TT, VV, and Z. Four occipital muſcles are ſeen in fig. 53. under *e e* and *f f*. At *a k* is repreſented a nerve of the firſt pair belonging to the ganglion of the neck; *b* is a branch of this nerve.

Fig. 54. exhibits the nerves as ſeen from the under part; but excepting in two or three nerves, which may be eaſily diſtinguiſhed, only one of each pair is drawn, in order to avoid confuſion. The nerves of the firſt ganglion of the neck are marked by capital letters, thoſe of the ganglion (a) of the head by Roman letters; the nerves of the ſmall ganglion by Greek characters. Thoſe of the frontal ganglion, except one, by numbers.

The muſcles of the coſſus have neither the colour nor form of thoſe of larger animals. In their natural ſtate they are ſoft, and of the conſiſtence of a jelly. Their colour is a greyiſh blue, which, with the ſilver-coloured appearance of the pulmonary veſſels, form a glorious ſpectacle. After the caterpillar has been ſoaked for ſome time in ſpirit of wine they loſe their elaſticity and tranſparency, becoming firm, opaque, and white, and the air-veſſels totally diſappear. The number of muſcles in a caterpillar is very great. The greateſt part of the head is compoſed of them, and there is a vaſt number about the œſophagus, inteſtines, &c. the ſkin is, as it were, lined by different beds of them, placed the one under the other, and ranged with great ſymmetry. M. Lyonet has been able to diſtinguiſh 228 in the head, 1647 in the body, and 2066 in the inteſtinal tube, making in all 4041.

At firſt ſight the muſcles might be taken for tendons, as being of the ſame colour, and having nearly the ſame luſtre. They are generally flat and of an equal ſize throughout; the middle ſeldom differing either in colour or ſize from either of the extremities. If they are ſeparated, however, by means of very fine needles, in a drop of ſome fluid, we find them compoſed not only of fibres, membranes, and air-veſſels, but likewiſe of nerves; and, from the drops of oil that may be ſeen floating on the fluid, they appear alſo to be furniſhed with many unctuous particles. Their ends are fixed to the ſkin, but the reſt of the muſcle is generally free and floating. Several of them branch out conſiderably; and the branches ſometimes extend ſo far, that it is not eaſy to diſcover whether they are diſtinct and ſeparate muſcles or parts of another. They are moderately ſtrong; and thoſe which have been ſoaked in ſpirit of wine, when examined by the microſcope are found to be covered with a membrane which may be ſeparated from them; and they appear then to conſiſt of ſeveral parallel bands lying longitudinally along the muſcle, which, when divided by means of fine needles, appear to be compoſed of ſtill ſmaller bundles of fibres lying in the ſame direction; which, when examined by a powerful magnifier, and in a favourable light, appear twiſted like a ſmall cord. The muſcular fibres of the ſpider, which are much larger than thoſe of the caterpillar, conſiſt of two different ſubſtances, one ſoft and the other hard; the latter being twiſted round the former ſpirally, and thus giving it the twiſted appearance juſt mentioned.

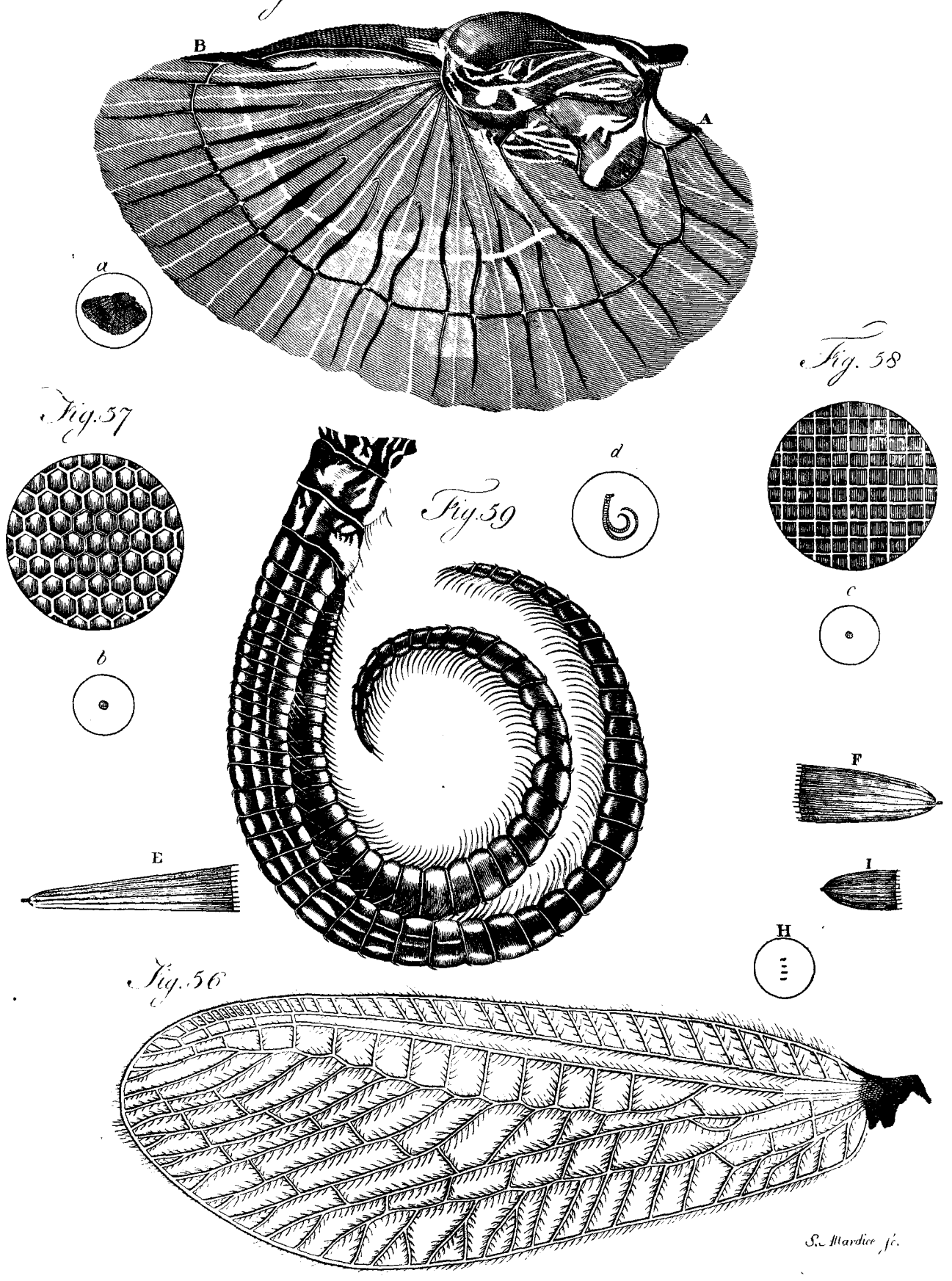
There is nothing in the caterpillar ſimilar to the brain in man. We find indeed in the head of this inſect a part from which all the nerves ſeem to proceed; but this part is entirely unprotected, and ſo ſmall, that it does not occupy one fifth part of the head: the ſurface is ſmooth, and has neither lobes nor any anfractuoſity like the human brain. But if we call this a brain in the caterpillar, we muſt ſay that it has *thirteen*: for there are twelve other ſuch parts following each other in a ſtraight line, all of them of the ſame ſubſtance with that in the head, and nearly of the ſame ſize; and from them, as well as from that in the head, the nerves are diſtributed thro' the body.

The ſpinal marrow in the coſſus goes along the belly; is very ſmall, forking out at intervals, nearly of the ſame thickneſs throughout, except at the ganglions, and is not incloſed in any caſe. It is by no means ſo tender as in man; but has a great degree of tenacity, and does not break without a conſiderable degree of tenſion. The ſubſtance of the ganglions differs from that of the ſpinal marrow, as no veſſels can be diſcovered in the latter; but the former are full of very delicate ones. There are 94 principal nerves, which divide into innumerable ramifications.

The coſſus has two large tracheal arteries, creeping under the ſkin cloſe to the ſpiracula; one at the right and the other at the left ſide of the inſect, each of them communicating with the air by means of nine ſpiracula. They are nearly as long as the whole caterpillar; beginning at the firſt ſpiraculum, and extending ſomewhat farther than the laſt; ſome branches alſo extending quite to the extremity of the body. Round each ſpiraculum the trachea puſhes forth a great number of branches, which are again divided into ſmaller ones, and theſe further ſubdivide and ſpread through the whole body of the caterpillar. The tracheal artery, with all its numerous ramifications, are open elaſtic veſſels, which may be preſſed cloſe together, or drawn out conſiderably, but return immediately to their uſual ſize when the tenſion ceaſes. They are naturally of a ſilver colour, and make a beautiful appearance. This veſſel, with its principal branches, is compoſed of three coats, which may be ſeparated from one another. The outmoſt is a thick membrane furniſhed with a great variety of fibres, which deſcribe a vaſt number of circles round it, communicating with each other by numerous ſhoots. The ſecond is very thin and tranſparent, without any particular veſſel being diſtinguiſhable in it. The third is compoſed of ſcaly threads, generally of a ſpiral form; and ſo near each other as ſcarcely to leave any interval. They are curiouſly united with the membrane which occupies the intervals; and form a tube which is always open, notwithſtanding the flexure of the veſſel. There are alſo many other peculiarities in its ſtructure. The principal tracheal veſſels divide into 1326 different branches.

The heart of the coſſus is very different from that of larger animals, being almoſt as long as the animal itſelf. It lies immediately under the ſkin at the top of the back, entering the head, and terminating near the mouth. Towards the laſt rings of the body it is large and capacious, diminiſhing very much as it approaches the head, from the fourth to the twelfth diviſion. On both ſides, at each diviſion, it has an appendage, which partly

Microscopic Objects



Microscopic Objects

Fig. 62

b

Fig. 65

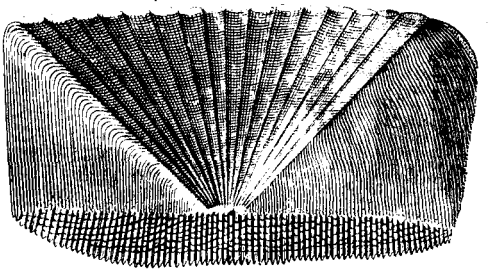
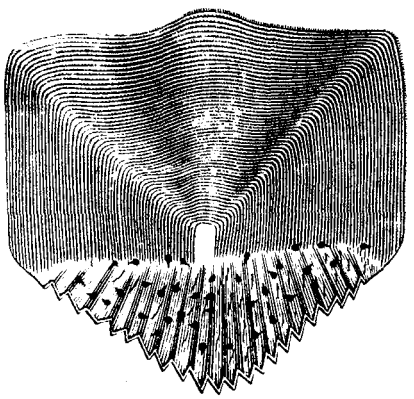


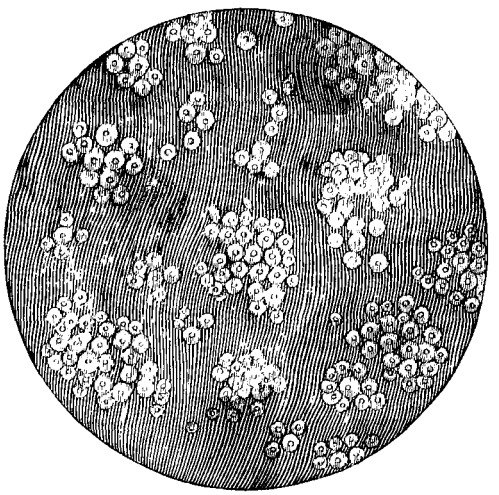
Fig. 64

l



h

Fig. 61



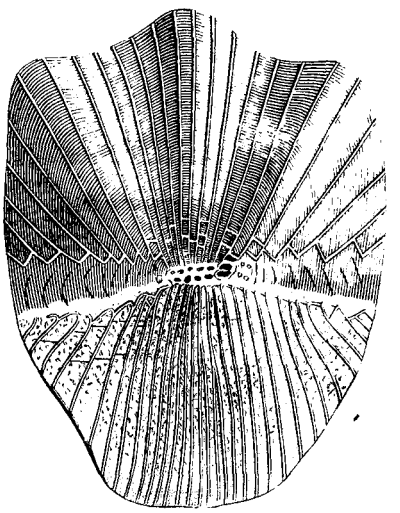
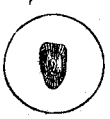


Fig. 63



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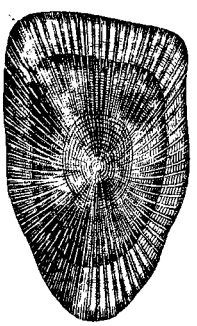
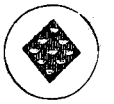


Fig. 66



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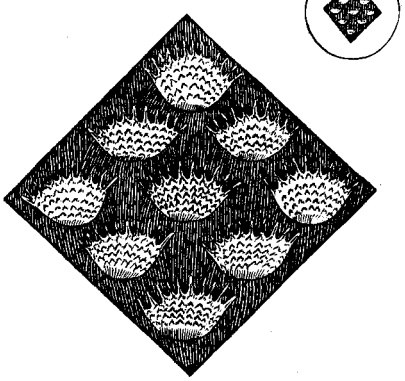
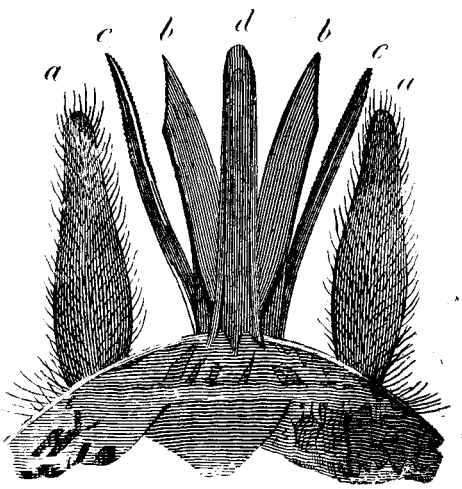


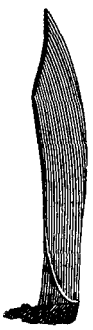
Fig. 60

f



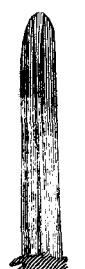
C

B



D

E



S. Mardon sc.

partly covers the muſcles of the back, but which growing narrower as it approaches the lateral line, it forms a number of irregular lozenge-ſhaped bodies.—This tube, however, ſeems to perform none of the functions of the heart in larger animals, as we find no veſſel opening into it which anſwers either to the aorta or vena cava. It is called the heart, becauſe it is generally filled with a kind of lymph, which naturaliſts have ſuppoſed to be the blood of the caterpillar; and becauſe in all caterpillars which have a tranſparent ſkin, we may perceive alternate regular contractions and dilatations along the ſuperior line, beginning at the eleventh ring, and proceeding from ring to ring, from the fourth; whence this veſſel is thought to be a ſtring or row of hearts. There are two white oblong bodies which join the heart near the eighth diviſion; and theſe have been called *reniform* bodies, from their having ſomewhat of the ſhape of a kidney.

The moſt conſiderable part of the whole caterpillar with regard to bulk is the corpus craſſum. It is the firſt and only ſubſtance that is ſeen on opening it. It forms a kind of ſheath which envelopes and covers all the entrails, and introducing itſelf into the head, enters all the muſcles of the body, filling the greateſt part of the empty ſpaces in the caterpillar. It very much reſembles the configuration of the human brain, and is of a milk-white colour.

The œſophagus deſcends from the bottom of the mouth to about the fourth diviſion. The fore-part, which is in the head, is fleſhy, narrow, and fixed by different muſcles to the cruſtaceous parts of it; the lower part which paſſes into the body, is wider, and forms a kind of membranaceous bag, covered with very ſmall muſcles; near the ſtomach it is narrower, and, as it were, confined by a ſtrong nerve fixed to it at diſtant intervals. The ventricle begins a little above the fourth diviſion where the œſophagus ends, and finiſhes at the tenth. It is about ſeven times as long as broad; and the anterior part, which is broadeſt, is generally folded. Theſe folds diminiſh with the bulk as it approaches the inteſtines; the ſurface is covered with a great number of aerial veſſels, and opens into a tube, which M. Lyonet calls the large inteſtine.—There are three of theſe large tubes, each of which differs ſo much from the reſt, as to require a particular name to diſtinguiſh it from them.

The two veſſels from which the coſſus ſpins its ſilk are often above three inches long, and are diſtinguiſhed into three parts; the anterior, intermediate, and poſterior. It has likewiſe two other veſſels, which are ſuppoſed to prepare and contain the liquor for diſſolving the wood on which it feeds.

Plate CCCIV.

Fig. 55 ſhews the wing of an earwig magnified; *a* repreſents it of the natural ſize. The wings of this inſect are ſo artificially folded up under ſhort caſes, that few people imagine they have any. Indeed, they very rarely make uſe of their wings. The caſes under which they are concealed are not more than a ſixth part of the ſize of one wing, though a ſmall part of the wing may be diſcovered, on a careful inſpection, projecting from under them. The upper part of the wing is cruſtaceous and opaque, but the under part is beautifully tranſparent. In putting up their wings, they firſt fold back the parts AB, and then ſhut up the ribs like a fan; the ſtrong muſcles uſed for this purpoſe being ſeen at the upper part of the figure. Some of the ribs are extended from the centre to the outer edge; others only from the edge about half way: but they are all united by a kind of band, at a ſmall but equal diſtance from the edge; the whole evidently contrived to ſtrengthen the wing, and facilitate its various motions. The inſect itſelf differs very little in appearance in its three different ſtates. De Geer aſſerts, that the female hatches eggs like a hen, and broods over her young ones as a hen does.

Fig. 56. repreſents a wing of the *Hemerobius perla* magnified. It is an inſect which ſeldom lives more than two or three days.—The wings are nearly of a length, and exactly ſimilar to one another. They are compoſed of fine delicate nerves, regularly and elegantly diſpoſed as in the figure, beautifully adorned with hairs, and lightly tinged with green. The body is of a fine green colour; and its eyes appear like two burniſhed beads of gold, whence it has obtained the name of *golden eye*. This inſect lays its eggs on the leaves of the plum or the roſe tree; the eggs are of a white colour, and each of them fixed to a little pedicle or foot-ſtalk, by which means they ſtand off a little from the leaf, appearing like the fructification of ſome of the moſſes. The larva proceeding from theſe eggs reſembles that of the coccinella or lady-cow, but is much more handſome. Like that, it feeds upon aphides or pucerons, ſucking their blood, and forming itſelf a caſe with their dried bodies; in which it changes into the pupa ſtate, from whence they afterwards emerge in the form of a fly.

Fig. E, F, I, repreſent the duſt of a moth's wing magnified. This is of different figures in different moths. The natural ſize of theſe ſmall plumes is repreſented at H.

Fig. 57. ſhows a part of the cornea of the libellula magnified. In ſome poſitions of the light, the ſides of the hexagons appear of a fine gold colour, and divided by three parallel lines. The natural ſize of the part magnified is ſhown at *b*.

Fig. 58. ſhows the part *c* of a lobſter's cornea magnified.

Fig. 59. ſhows one of the arms or horns of the lepas antifera, or barnacle, magnified; its natural ſize being repreſented at *d*. Each horn conſiſts of ſeveral joints, and each joint is furniſhed on the concave ſide of the arm with long hairs. When viewed in the microſcope the arms appear rather opaque; but they may be rendered tranſparent, and become a moſt beautiful object, by extracting out of the interior cavity a bundle of longitudinal fibres, which runs the whole length of the arm. Mr Needham thinks that the motion and uſe of theſe arms may illuſtrate the nature of the rotatory motion in the wheel-animal. In the midſt of the arms is an hollow trunk, conſiſting of a jointed hairy tube, which incloſes a long round tongue that can be puſhed occaſionally out of the tube or ſheath, and retracted occaſionally. The mouth of the animal conſiſts of ſix laminæ, which go off with a bend, indented like a ſaw on the convex edge, and by their circular diſpoſition are ſo ranged, that the teeth, in the alternate elevation and depreſſion of each plate, act againſt whatever comes between them. The plates are placed together in ſuch a manner, that to the naked eye they form an aperture not much unlike the mouth of a contracted purſe.

Fig. 60. ſhows the apparatus of the *Tabanus* or Ga-

Microscope Midas.

fly, by which it pierces the skin of horses and oxen, in order to suck their blood. The whole is contained in a fleshy case, not expressed in the figure. The feelers *a a* are of a spongy texture and grey colour, covered with short hairs. They are united to the head by a small joint of the same substance. They defend the other parts of the apparatus, being laid upon it side by side whenever the animal stings, and thus preserve it from external injury. The wound is made by the two lancets *bb* and B, which are of a delicate structure but very sharp, formed like the dissecting knife of an anatomist, growing gradually thicker to the back.—The two instruments *c c* and C, appear as if intended to enlarge the wound by irritating the parts round it: for which they are jagged or toothed. They may also serve, from their hard and horny texture, to defend the tube *e* E, which is of a softer nature, and tubular, to admit the blood, and convey it to the stomach. This part is totally inclosed in a line *d* D, which entirely covers it. These parts are drawn separately at B, C, D, E. De Geer observes, that only the females suck the blood of animals; and Reaumer informs us, that having made one, that had sucked its fill, disgorge itself, the blood it threw up appeared to him to be more than the whole body of the insect could have contained. The natural size of this apparatus is shown at *f*.

Fig. 61. shows a bit of the skin of a lump-fish (*Cyclopterus*) magnified. When a good specimen of this can be procured, it forms a most beautiful object. The tubercles exhibited in the figure probably secrete an unctuous juice.

Fig. 62. shows the scale of a sea-perch found on the English coast; the natural size is exhibited at *h*.

Fig. 63. is the scale of an haddock magnified; its natural size as within the circle.

Fig. 64. the scale of a parrot fish from the West Indies magnified; *l* the natural size of it.

Fig. 65. the scale of a kind of perch in the West Indies magnified; *k* the natural size of the scale.

Fig. 66. part of the skin of a sole fish, as viewed through an opaque microscope; the magnified part, in its real size, shown at *l*.

The scales of fishes afford a great variety of beautiful objects for the microscope. Some are long; others round, square, &c. varying considerably not only in different fishes, but even in different parts of the same fish. Leeuwenhoeck supposed them to consist of an infinite number of small scales or strata, of which those next to the body of the fish are the largest. When viewed by the microscope, we find some of them ornamented with a prodigious number of concentric flutings too near each other, and too fine to be easily enumerated. These flutings are frequently traversed by others diverging from the centre of the scale, and generally proceeding from thence in a straight line to the circumference.

For a more full information concerning these and other microscopical objects, the reader may consult Mr Adams's *Essays on the Microscope*, who has made the most valuable collection that has yet appeared on the subject. See also the articles ANIMALCULE, CRYSTALLIZATION, POLYPE, PLANTS, and WOOD, in the present Work.

MIDAS (fab. hist.), a famous king of Phrygia, who having received Bacchus with great magnificence, that god, out of gratitude, offered to grant him whatever he should ask. Midas desired that every thing he touched should be changed into gold. Bacchus consented; and Midas, with extreme pleasure, every where found the effects of his touch. But he had soon reason to repent of his folly: for wanting to eat and drink, the aliments no sooner entered his mouth than they were changed into gold. This obliged him to have recourse to Bacchus again, to beseech him to restore him to his former state; on which the god ordered him to bathe in the river Pactolus, which from thence forward had golden sands. Some time after, being chosen judge between Pan and Apollo, he gave another instance of his folly and bad taste, in preferring Pan's music to Apollo's; on which the latter being enraged, gave him a pair of asses ears. This Midas attempted to conceal from the knowledge of his subjects: but one of his servants saw the length of his ears, and being unable to keep the secret, yet afraid to reveal it from apprehension of the king's resentment, he opened a hole in the earth, and after he had whispered there that Midas had the ears of an ass, he covered the place as before, as if he had buried his words in the ground. On that place, as the poets mention, grew a number of reeds, which when agitated by the wind uttered the same sound that had been buried beneath and published to the world that Midas had the ears of an ass. Some explain the fable of the ears of Midas, by the supposition that he kept a number of informers and spies, who were continually employed in gathering every seditious word that might drop from the mouths of his subjects. Midas according to Strabo, died of drinking bull's hot blood. This he did, as Plutarch mentions, to free himself from the numerous ill dreams which continually tormented him. Midas, according to some, was son of Cybele. He built a town which he called *Ancyræ*.

MIDAS, *Ear-shell*, the smooth ovato-oblong buccinum, with an oblong and very narrow mouth. It consists of six volutions, but the lower one alone makes up almost the whole shell.

MID-HEAVEN, the point of the ecliptic that culminates, or in which it cuts the meridian.

MIDDLEBURG, one of the Friendly Islands in the South Sea. This island was first discovered by Tasman, a Dutch navigator, in January 1742-3; and is called by the natives *Ea-Oo-whe*: it is about 16 miles from north to south, and in the widest part about 8 miles from east to west. The skirts are chiefly laid out in plantations, the south-west and north-west sides especially. The interior parts are but little cultivated, though very capable of it; but this neglect adds greatly to the beauty of the island; for here are agreeably dispersed groves of cocoa-nuts and other trees, lawns covered with thick grass, here and there plantations and paths leading to every part of the island, in such beautiful disorder, as greatly to enliven the prospect. The hills are low; the air is delightful; but unfortunately water is denied to this charming spot. Yams, with other roots, bananas, and bread-fruit, are the principal articles of food; but the latter appeared to be scarce. Here is the pepper tree, or *ava-ava*, with which they make an intoxicating liquor, in the same disgusting manner as is practised in the Society Islands. Here are several ordoriferous trees and shrubs, par-

Midas || Middleburg.

Middleburg.

particularly a ſpecies of the lemon tribe; and the botanical gentlemen met with various new ſpecies of plants. Here alſo are a few hogs and fowls.

There are no towns or villages; moſt of the houſes are built in plantations, which are laid out in different parts, with no other order than what convenience requires. They are neatly conſtructed, but are leſs roomy and convenient than thoſe in the Society Iſles. The floors are a little raiſed, and covered with thick. ſtrong mats. The ſame ſort of matting ſerves to incloſe them on the windward ſide, the others being open. They have little areas before moſt of them, which are planted round with trees or ornamental ſhrubs, whoſe fragrance perfumes the air. Their houſehold furniture conſiſts of a few wooden platters, cocoa-nut ſhells, and pillows made of wood, and ſhaped like four-footed ſtools or forms: their common clothing, with the addition of a mat, ſerves them for bedding.

The natives are of a clear mahogany or cheſnut brown, with black hair, in ſhort frizzled curls, which ſeems to be burnt at the tips; their beards are cut or ſhaven. The general ſtature of the men is equal to our middle ſize, from five feet three to five feet ten inches; the proportions of the body are very fine, and the *contours* of the limbs extremely elegant, though ſomething more muſcular than at Otaheitee, which may be owing to a greater and more conſtant exertion of ſtrength in their agriculture and domeſtic economy. Their features are extremely mild and pleaſing; and differ from the old Otaheitian faces in being more oblong than round, the noſe ſharper, and the lips rather thinner. The women are, in general, a few inches ſhorter than the men, but not ſo ſmall as the lower claſs of women at the Society Iſlands. The practice of puncturing the ſkin, and blacking it, which is called *tattowing*, is in full force among the men here, for their belly and loins are very ſtrongly marked in configurations more compounded than thoſe at Otaheite. The tendereſt parts of the body were not free from theſe punctures; the application of which, beſides being very painful, muſt be extremely dangerous on glandulous extremities.

The men in general go almoſt naked, having only a ſmall piece of cloth round the loins, but ſome wrapt it in great abundance round them from their waiſt: this cloth is manufactured much like that at Otaheitee, but overſpread with a ſtrong glue, which makes it ſtiff, and fit to reſiſt the wet. The women are likewiſe covered from the waiſt downwards: they often have looſe necklaces, conſiſting of ſeveral ſtrings of ſmall ſhells, ſeeds, teeth of fiſhes; and in the middle of all, the round *operculum*, or cover of a ſhell as large as a crown-piece. The men frequently wear a ſtring round their necks, from which a mother-of-pearl ſhell hangs down on the breaſt; both the ears of the women were perforated with two holes, and a cylinder cut out of tortoiſe-ſhell or bone was ſtruck through both the holes. The moſt remarkable circumſtance obſerved of this people was, that moſt of them wanted the little finger on one, and ſometimes on both hands: the difference of ſex or age did not exempt them from this amputation; for even among the few children that were ſeen running about naked, the greater part had already ſuffered ſuch loſs. This circumſtance was obſerved by Taſman. Another ſingularity which was obſerved to be very general among theſe people, was a round ſpot on each cheek-bone, which appeared to have been burnt or bliſtered. On ſome it ſeemed to have been recently made, on others it was covered with, ſcurf, and many had only a ſlight mark of its former exiſtence: how, or for what purpoſe it was made, could not be learnt. The women here, in general, were reſerved; and turned, with diſguſt, from the immodeſt behaviour of ungovernable ſeamen: there were not, however, wanting ſome who appeared to be of eaſy virtue, and invited their lovers with laſcivious geſtures. The language ſpoken here is ſoft, and not unpleaſing; and whatever they ſaid was ſpoken in a kind of ſinging tone. Omai and Mahine, who were both paſſengers on board the ſhip, at firſt declared that the language was totally new and unintelligible to them; however, the affinity of ſeveral words being pointed out, they ſoon caught the particular modification of this dialect, and converſed much better with the natives than any on board the ſhips could have done, after a long intercourſe. They have the neateſt ornaments imaginable, conſiſting of a number of little flat ſticks, about five inches long, of a yellow wood like box, firmly and elegantly connected together at the bottom by a tiſſue of the fibres of cocoa-nut, ſome of which were of their natural colour, and others dyed black; the ſame fibres were likewiſe uſed in the making of baſkets, the taſte of which was highly elegant, and varied into different forms and patterns. Their clubs are of a great variety of ſhapes, and many of them ſo ponderous as ſcarce to be managed with one hand. The moſt common form was quadrangular, ſo as to make a rhomboid at the broad end, and gradually tapering into a round handle at the other. Far the greater part were carved all over in many chequered patterns, which ſeemed to have required a long ſpace of time, and incredible patience, to work up; as a ſharp ſtone, or a piece of coral, are the only tools made uſe of: the whole ſurface of the plain clubs was as highly poliſhed as if an European workman had made them with the beſt inſtruments. Beſides clubs, they have ſpears of the ſame wood, which were ſometimes plain ſharp-pointed ſticks, and ſometimes barbed with a ſting-ray's tail. They have likewiſe bows and arrows of a peculiar conſtruction: the bow; which is ſix feet long, is about the thickneſs of a little finger, and when ſlack forms a ſlight curve; its convex part is channelled with a ſingle deep groove, in which the bow-ſtring is lodged. The arrow is made of reed, near ſix feet long, and pointed with hard wood: when the bow is to be bent, inſtead of drawing it ſo as to increaſe the natural curvature, they draw it the contrary way, making it perfectly ſtraight, and then form the curve on the other ſide. Moſt of their canoes have outriggers, made of poles, and their workmanſhip is very admirable: two of theſe canoes are joined together with a ſurpriſing exactneſs, and the whole ſurface receives a very curious poliſh. Their paddles have ſhort broad blades, ſomething like thoſe at Otaheitee, but more neatly wrought and of better wood.

They keep their dead above ground, after the manner of the Society iſlands; as a corpſe was ſeen depoſited on a low hut.

Here were ſeen ſeveral men and women afflicted with leprous diſeaſes, in ſome of whom the diſorder had riſen to a high degree of virulence: one man in-

particular had his back and ſhoulders covered with a large cancerous ulcer, which was perfectly livid within, and of a bright yellow all round the edges. A woman was likewiſe unfortunate enough to have her face deſtroyed by it in the moſt ſhocking manner; there was only a hole left in the place of her noſe; her cheek was ſwelled up, and continually oozing out a purulent matter; and her eyes ſeemed ready to fall out of her head, being bloody and ſore: though theſe were ſome of the moſt miſerable ojects that could poſſibly be ſeen, yet they ſeemed to to be quite unconcerned about their misfortunes, and traded as briſkly as any of the reſt.

MIDDLELAM, a town in the north-riding of Yorkſhire, ſituated on the river Ure, 255 miles from London. It had once a caſtle, where was born Edward prince of Wales, only ſon of Richard III.; and is noted for a woollen manufactory and frequent horſe-races. Its market is on Monday; and fairs Nov. 6 and 7. The town ſtands on a riſing ground; and the caſtle, which was on the ſouth ſide, was formerly moated round by the help of a ſpring conveyed in pipes from the higher grounds. The church of Middlelam is extra-parochial.

MIDDLESEX, a county of England, which derives its name from its ſituation amidſt the three kingdoms of the Eaſt, Weſt, and South Saxons. It is bounded on the north by Hertfordſhire; on the ſouth by the river Thames, which divides it from Surry; on the weſt by the river Colne, which ſeparates it from Buckinghamſhire; and on the eaſt by the river Lea, which divides it from Eſſex. It extends about 23 miles in length, but hardly 14 in breadth, and is not more than 115 in circumference; but as it comprehends the two vaſt cities of London and Weſtminſter, which are ſituated in the ſouth-eaſt part of the county, it is by far the wealthieſt and moſt populous county in England. It is divided into 602 liberties, containing 200 pariſhes, beſides a vaſt number of chapels of eaſe, and 5 market-towns, excluſive of the cities of London and Weſtminſter. The air is very pleaſant and healthy, to which a fine gravelly ſoil does not a little contribute. The ſoil produces plenty of corn, and the county abounds with fertile meadows and gardeners grounds. In a word, the greater part of the county is ſo prodigiouſly aſſiſted by the rich compoſt from London, that the whole of the cultivated part may be conſidered as a garden. The natural productions are cattle, corn, and fruit; but its manufactures are too many to be enumerated here, there being hardly a ſingle manufacture practiſed in Great Britain but what is alſo eſtabliſhed in this county.—Though London is the chief city, Brentford is the county-town where the members of parliament are elected.

MIDDLETON (Dr Conyers), a very celebrated Engliſh divine, the ſon of a clergyman in Yorkſhire, was born at Richmond in 1683. He diſtinguiſhed himſelf, while fellow of Trinity-college, Cambridge, by his controverſy with Dr Bentley his maſter, relating to ſome mercenary conduct of the latter in that ſtation. He afterwards had a controverſy with the whole body of phyſicians, on the dignity of the medical profeſſion; concerning which he publiſhed *De medicorum apud veteres Romanos degentium conditione diſſertatio; qua, contra viros celeberrimos Jacobum Sponium et Richardum Meadium, ſervilem atque ignobilem eam fuiſſe, oſtenditur:* and in the courſe of this diſpute much reſentment and many pamphlets appeared. Hitherto he had ſtood well with his clerical brethren; but he drew the reſentment of the church on him in 1729, by writing "A letter from Rome, ſhowing an exact conformity between popery and paganiſm," &c.; as this letter, though politely written, yet attacked Popiſh miracles with a gaiety that appeared dangerous to the cauſe of miracles in general. Nor were his Objections to Dr Waterland's manner of vindicating Scripture againſt Tindal's "Chriſtianity as old as the Creation," looked on in a more favourable point of view. In 1741, came out his great work, "The hiſtory of the life of M. Tullius Cicero," 2 vols 4to; which is indeed a fine performance, and will probably be read as long as taſte and polite literature ſubſiſt among us: the author has nevertheleſs fallen into the common error of biographers, who often give panegyrics inſtead of hiſtory. In 1748, he publiſhed, "A free inquiry into the miraculous powers which are ſuppoſed to have ſubſiſted in the Chriſtian church from the earlieſt ages, through ſeveral ſucceſſive centuries." He was now attacked from all quarters; but before he took any notice of his antagoniſts, he ſupplied them with another ſubject in "An examination of the lord biſhop of London's diſcourſes concerning the uſe and extent of prophecy," &c. Thus Dr Middleton continued to diſplay talents and learning, which were highly eſteemed by men of a free turn of mind, but by no means in a method calculated to invite promotion in the clerical line. He was in 1723 choſen principal librarian of the public library at Cambridge; and if he roſe not to dignities in the church, he was in eaſy circumſtances, which permitted him to aſſert a dignity of mind often forgotten in the career of preferment. He died in 1750, at Hilderſham in Cambridgeſhire, an eſtate of his own purchaſing; and in 1752, all his works, except the life of Cicero, were collected in 4 vols, 4to.

MIDDLEWICH, a town of Cheſhire, 167 miles from London. It ſtands near the conflux of the Croke and Dan, where are two ſalt-water ſprings, from which are made great quantities of ſalt, the brine being ſaid to be ſo ſtrong as to produce a full fourth part ſalt. It is an ancient borough, governed by burgeſſes; and its pariſh extends into many adjacent townſhips. It has a ſpacious church. Its market is on Tueſdays; and fairs on St James's-day, July 25. and Holy-Thurſday. By the late inland navigation, it has communication with the rivers Merſey, Dee, Ribble, Ouſe, Trent, Darwent, Severn, Humber, Thames, Avon, &c. which navigation, including its windings extends above 500 miles, in the counties of Lincoln, Nottingham, York, Lancaſter, Weſtmoreland, Stafford, Warwick, Leiceſter, Oxford, Worceſter, &c. The river Wheelock, after a courſe of about 12 miles from Mow-cop-hill, runs into the Dan a little above this town.

MIDHURST, a town of Suſſex, 52 miles from London, has been repreſented in parliament ever ſince the 4th of Edward II. It is a neat ſmall town, on a hill ſurrounded with others, having the river Arun at the bottom; and is a borough by preſcription, governed by a bailiff, choſen annually by a jury at a court-leet of the lord of the manor. The market is on Thurſday; fairs on March 21. and the Thurſday after.

MIDIAN,

Midian || Midshipman.

MIDIAN, or MADIAN (anc. geog.), a town on the south side of Arabia Petræa; so called from one of the sons of Abraham by Keturah.—Another *Midian*, near the Arnon and Æoplis, in ruins in Jerom's time. With the daughters of these Midianites the Israelites committed fornication, and were guilty of idolatry. A branch of the Midianites dwelt on the Arabian gulph, and were called *Kenites*; some of whom turned proselytes, and dwelt with the Israelites in the land of Canaan.

MID-LOTHIAN. See LOTHIAN.

MIDSHIP-FRAME, a name given to that timber, or combination of pieces formed into one timber, which determines the extreme breadth of the ship, as well as the figure and dimension of all the inferior timbers

In the article *Ship-building*, the reader will find a full explanation of what is meant by a frame of timbers. He will also perceive the outlines of all the principal frames, with their gradual dimensions, from the midship-frame delineated in the plane of projection annexed to that article. As the parts of which the several frames are composed have the same relation to each other throughout the vessel, and as all the corresponding pieces, without and within those frames, are also nearly alike, and fixed in the same manner, it will be here sufficient for our purpose to represent the principal or midship-frame, together with its corresponding parts, which are as follow:—A, the keel, with *a* the false keel beneath it. B, the chocks fixed upon the kelson, to retain the opposite pieces of the *riders* firmly together. C, one of the beams of the orlop. D, one of the lower deck beams; with *d* the beams of the upper deck. E, the hanging-knees, by which the beams are attached to the timbers. F, the standards, which are fixed above the decks to which they belong. G, the clamps, which sustain the extremities of the beams. H, the gun-ports of the lower-deck; with *h* the ports of the upper-deck. I, K, L, different pieces of *thick-stuff*, placed opposite to the several scarfs or joinings, in the frame of timbers. M, the planks of the deck. N, the water-ways. O, the planks of the ceiling, between the several ranges of thick-stuff. P, the spirketing. Q, the main-wale, to fortify the ship's side opposite to the lower deck. R, the channel-wale, opposite to the upper deck. S, the waist-rail. T, the string, with the moulding under the gun-wale. U, the floor-timbers, which are laid across the keel and bolted to it. V, the several futtocks; and W the top-timbers, which are all united into one frame. X, the kelson.

Plate CCCXIII.

MIDSHIPMAN, a sort of naval cadet, appointed by the captain of a ship of war, to second the orders of the superior officers, and assist in the necessary business of the vessel, either aboard or ashore.

The number of midshipmen, like that of several other officers, is always in proportion to the size of the ship to which they belong. Thus a first-rate man of war has 24, and the inferior rates a suitable number in proportion. No person can be appointed lieutenant without having previously served two years in the royal navy in this capacity, or in that of *mate*, besides having been at least four years in actual service at sea, either in merchant-ships or in the royal navy.

Midshipman is accordingly the station in which a young volunteer is trained in the several exercises necessary to attain a sufficient knowledge of the machinery, movements, and military operations of a ship, to qualify him for a sea-officer.

Midshipman.

On his first entrance in a ship of war, every midshipman has several disadvantageous circumstances to encounter. These are partly occasioned by the nature of the sea-service; and partly by the mistaken prejudices of people in general respecting naval discipline, and the genius of sailors and their officers. No character, in their opinion, is more excellent than that of the common sailor, whom they generally suppose to be treated with great severity by his officers, drawing a comparison between them not very advantegeous to the latter. The midshipman usually comes aboard tinctured with these prejudices, especially if his education has been amongst the higher rank of people; and if the officers happen to answer his opinion, he conceives an early disgust to the service, from a very partial and incompetent view of its operations. Blinded by these prepossessions, he is thrown off his guard, and very soon surprised to find, amongst those honest sailors, a crew of abandoned miscreants, ripe for any mischief or villany. Perhaps, after a little observation, many of them will appear to him equally destitute of gratitude, shame, or justice, and only deterred from the commission of any crimes by the terror of severe punishment. He will discover, that the pernicious example of a few of the vilest in a ship of war is too often apt to poison the principles of the greatest number especially if the reins of discipline are too much relaxed, so as to foster that idleness and dissipation, which engender sloth, diseases, and an utter profligacy of manners. If the midshipman on many occasions is obliged to mix with these, particularly in the exercises of extending or reducing the sails in the tops, he ought resolutely to guard against this contagion, with which the morals of his inferiors may be infected. He should, however, avail himself of their knowledge, and acquire their expertness in managing and fixing the sails and rigging, and never suffer himself to be excelled by an inferior. He will probably find a virtue in almost every private sailor, which is entirely unknown to many of his officers: that virtue is emulation, which is not indeed mentioned amongst their qualities by the gentleman of *terra firma*, by whom their characters are often copiously described with very little judgement. There is hardly a common tar who is not envious of superior skill in his fellows, and jealous on all occasions to be outdone in what he considers as a branch of his duty; nor is he more afraid of the dreadful consequences of whistling in a storm, than of being stigmatised with the opprobrious epithet of *lubber*. Fortified against this scandal, by a thorough knowledge of his business, the sailor will sometimes sneer in private at the execution of orders which to him appear aukward, improper, or unlike a seaman. Nay, he will perhaps be malicious enough to suppress his own judgment, and, by a punctual obedience to command, execute whatever is to be performed in a manner which he knows to be improper, in order to expose the person commanding to disgrace and ridicule. Little skilled in the method of the schools, he considers the officer

Midſhipman.

officer who cons his leſſon by rote as very ill qualified for his ſtation, becauſe particular ſituations might render it neceſſary for the ſaid officer to aſſiſt at putting his own orders in practice. An ignorance in this practical knowledge will therefore neceſſarily be thought an unpardonable deficiency by thoſe who are to follow his directions. Hence the midſhipman who aſſociates with theſe ſailors in the tops, till he has acquired a competent ſkill in the ſervice of extending or reducing the ſails, &c. will be often entertained with a number of ſcurrilous jeſts, at the expence of his ſuperiors. Hence alſo he will learn, that a timely application to thoſe exerciſes can only prevent him from appearing in the ſame deſpicable point of view, which muſt certainly be a cruel mortification to a man of the ſmalleſt ſenſibility.

If the midſhipman is not employed in theſe ſervices, which are undoubtedly neceſſary to give him a clearer idea of the different parts of his occupation, a variety of other objects preſent themſelves to his attention. Without preſuming to dictate the ſtudies which are moſt eſſential to his improvement, we could wiſh to recommend ſuch as are moſt ſuitable to the bent of his inclination. Aſtronomy, geometry, and mechanics, which are in the firſt rank of ſcience, are the materials which form the ſkilful pilot and the ſuperior mariner. The theory of navigation is entirely derived from the two former, and all the machinery and movements of a ſhip are founded upon the latter. The action of the wind upon the ſails, and the reſiſtance of the water at the ſtem, naturally dictate an inquiry into the property of ſolids and fluids; and the ſtate of the ſhip, floating on the water, ſeems to direct his application to the ſtudy of hydroſtatics, and the effects of gravity. A proficiency in theſe branches of ſcience will equally enlarge his views, with regard to the operations of naval war, as directed by the efforts of powder and the knowledge of projectiles. The moſt effectual method to excite his application to thoſe ſtudies, is, perhaps, by looking round the navy, to obſerve the characters of individuals. By this inquiry he will probably diſcover, that the officer who is eminently ſkilled in the ſciences, will command univerſal reſpect and approbation; and that whoever is ſatisfied with the deſpicable ambition of ſhining the hero of an aſſembly, will be the object of univerſal contempt. The attention of the former will be engaged in thoſe ſtudies which are highly uſeful to himſelf in particular, and to the ſervice in general. The employment of the latter is to acquire thoſe ſuperficial accompliſhments that unbend the mind from every uſeful ſcience, emaſculate the judgment, and render the hero infinitely more dexterous at falling into his ſtation in the dance than in the line of battle.

Unleſs the midſhipman has an unconquerable averſion to the acquiſition of thoſe qualifications which are ſo eſſential to his improvement, he will very rarely want opportunities of making a progreſs therein. Every ſtep he advances in thoſe meritorious employments will facilitate his acceſſion to the next in order. If the dunces, who are his officers or meſs-mates, are rattling the dice, roaring bad verſes, hiſſing on the flute, or ſcraping diſcord from the fiddle, his attention to more noble ſtudies will ſweeten the hours of relaxation. He ſhould recollect, that no example from fools ought to influence his conduct, or ſeduce him from that laudable ambition which his honour and advantage are equally concerned to purſue.

MIDWIFE, one whoſe profeſſion is to deliver women in labour. See MIDWIFERY.

MIDWIFERY,

THE art of aſſiſting women in the birth of children. It is ſuppoſed to comprehend alſo the management of women both before and after delivery, as well as the treatment of the child in its moſt early ſtate.

History of Midwifery. The art of midwifery is certainly almoſt coeval with mankind. The firſt *midwife* of whom mention is made under that name, aſſiſted at the ſecond labour of Rachel, the wife of Jacob. Another midwife is ſpoken of in Geneſis, at the lying-in of Thamar, who was delivered of twins. But the moſt honourable mention of midwives is that in Exodus, when Pharaoh king of Egypt, who had a mind to deſtroy the Hebrews, commanded the midwives to kill all the male children of the Hebrew women; which command they diſobeyed, and thereby obtained a recompence from God.

From all the paſſages in Scripture where midwives are mentioned, it is plain, that women were the only practitioners of this art among the Hebrews. Among the Greeks alſo women aſſiſted at labours. Phanarete, the mother of Socrates, was a midwife. Plato ſpeaks at large of midwives, explains their functions, regulates their duties, and remarks that they had at Athens the right of propoſing or making marriages. Hippocrates makes mention of midwives, as well as Ariſtotle, Galen, and Aetius. This laſt even frequently quotes a woman called *Aſpaſia*, who was probably a midwife. They were called among the Greeks Μαῖαι or Ἰατρομαῖαι; that is to ſay, *mamma*, or *grandmamma*.

We are ſtill better acquainted with the cuſtoms of the Romans, and know that they employed women only. This may be deduced from the comedies of Plautus and Terence alone. We there ſee that they are women only who are called to aſſiſt perſons in labour. Beſides, Pliny, in his Natural Hiſtory, frequently ſpeaks of midwives and their duties; and names two, *Sotira* and *Salpe*, who had apparently the greateſt reputation. Women were alſo employed after the fall of the empire; and it is certain, that, till lately, all civilized nations have employed women only as midwives. This appears even from their names in many different languages, which are all feminine. There were, however, eſpecially in great cities, ſurgeons who applied themſelves to the art of midwifery, and made it their particular ſtudy. They were ſent for in

in difficult cases, where the midwives found their incapacity; and then the surgeon endeavoured to deliver the woman by having recourse to instruments useful in those cases, as by crotchets, crows-bills, &c.; but as these cases happened but seldom, women remained in possession of this business. It is certain according to Astruc, that Maria Theresia wife of Louis XIV. employed women only in her labours; and the example of the queen determined the conduct of the princesses and court-ladies, and likewise of the other ladies of the city. The same author tells us, that he has been assured, that the epoch of the employment of men-midwives goes no farther back than the first lying-in of Madam de la Valiere in 1663. As she desired it might be kept a profound secret, she sent for Julian Clement a surgeon of reputation. He was conducted with the greatest secrecy into an house where the lady was, with her face covered with a hood; and where it is said the king was concealed in the curtains of the bed. The same surgeon was employed in the subsequent labours of the same lady; and as he was very successful with her, men-midwives afterwards came into repute, and the princesses made use of surgeons on similar occasions; and as soon as this became fashionable, the name of *acoucheur* was invented to signify this class of surgeons. Foreign countries soon adopted the custom, and likewise the name of *acoucheurs*, though they had no such term in their own language; but in Britain they have more generally been called *men-midwives*.

In opposition to this account, which is taken from Astruc, that author tells us, that he is aware of an objection from Hyginus, who asserts, that the ancients had no midwives; which made the women, through modesty, rather choose to run the risk of death than to make use of men on this occasion. For the Athenians, he adds, had forbid women and slaves to study physic, that is to say, the art of midwifery. A young woman, named *Agnodice*, desirous of learning this art, cut off her hair, dressed herself in the habit of a man, and became a scholar to one Hierophilus. She afterwards followed this business. The women at first refused assistance from her, thinking she was a man; but accepted thereof when she had convinced them that she was a woman.

To this account our author replies, that the authority of Hyginus is by no means to be depended upon. His book is full of solecisms and barbarisms; and therefore cannot be attributed to any writer who lived before the fall of the empire; but must have been the work of another author who lived when the Latin tongue was corrupted; that is, about the seventh or eighth century. The contradictions met with in this book also give room to suspect that it is not the work of one hand, but of several. The authority of such a work, therefore is by no means sufficient to destroy the testimonies of those writers who affirm, that among the Greeks the care of lying-in women was committed entirely to others of their own sex.

The art of midwifery seems not to have been so soon improved as that of physic. Hippocrates, though an excellent physician, seems to have been a very bad midwife. He was acquainted with no other kind of natural labour than that in which the head presents; and condemns footling labour as fatal both to mother and child: he would have the children in such cases turned, so that the head may present. If, says he, the arm, or leg, or both, of a living child present, they must, as soon as discovered, be returned into the womb, and the child brought into the passage with its head downwards. For this purpose he advises to roll the woman on the bed, to shake her and make her jump: he proposes the same expedients to procure the child's delivery; and if they do not succeed, he advises to extract it with crotchets, and, whatever happens, to dismember it.

From the time of Hippocrates to that of Celsus, who lived in the reign of the emperor Tiberius, we have no accounts of any improvements in midwifery; but this author gives two very useful directions. 1. In dilating the womb; "We must (says he) introduce the fore-finger, well moistened with hog's lard, into the mouth of the womb when it begins to open, and in like manner afterwards a second, and so on until all the fingers are introduced, which are then to be used by separating them as a kind of dilater, to distend the orifice, and facilitate the introduction of the hand which is to act in the womb. 2. Children may be delivered by the feet easily and safely, without crotchets, by taking hold of their legs. For this purpose we must take care to turn children, which are otherwise placed in the womb with their head or feet downwards." It is true, Celsus speaks of a dead child only; but it was easy to conclude from thence, that the same practice might be used with success to deliver a living child. Nevertheless, this was not done; and, notwithstanding the authority of Celsus, the former prejudice continued for a long time. Though Pliny, who lived under the emperors Vespasian and Titus, was not a physician himself, yet by condemning footling labour he attests the opinion of the physicians of his time. He asserts, as a known fact, that footling abour was a preternatural kind of labour; he adds, that children which came into the world in this manner were called *Agrippa*, that is to say, born with a great deal of difficulty.

But however common this opinion was, it was never universally received; and several physicians of character rose up, who, without suffering themselves to be dazzled with the common prejudice, or seduced by the authority of Hippocrates or Galen, recommended and approved of footling delivery. The question then was a long time undecided; and even in 1657, Riverius, a physician of reputation, condemned footling labour. Mauriceau also remarks, in the first edition of his book on the disorders of pregnant women, printed in 1664, that many authors were still of opinion, that when the child presented with its feet, it should be turned to make it come with its head foremost; but after having observed that it is difficult, if not impossible, to execute this, he concludes, "it is much better to extract the child by its feet when they present, than to run the hazard of doing worse by turning it." All practitioners, however, are now of the same opinion; and the knowledge of midwifery has been so much increased within this century, that it seems to have nearly attained its ultimate perfection, and its operations reduced almost to a geometrical certainty: And this, says Astruc, is not surprising; for, after all the art of midwifery is reduced to the following me-

chanical problem, "An extensible cavity of a certain capacity being given, to pass a flexible body of a given length and thickness through an opening dilatable to a certain degree." This might be resolved geometrically, if the different degrees of elasticity of the womb, and strength and weakness of the child, the greater or lesser disposition of the blood to inflammation, and the greater or lesser degree of irritability of the nerves, did not occasion that uncertainty which physical facts constantly produce in all physico-mathematical questions.

The study of midwifery in Britain as a science is not of very ancient date. The first book published on the subject appeared in the year 1540, and was intitled *The Byrthe of Mankind*, otherwise named, *The Woman's Booke*, by Thomas Raynold, physition. It underwent a second edition by Thomas Ray, a printer whose name is not much known. It was adorned with prints, and went through several editions, and appears to have been held in high estimation. In 1653, the celebrated William Harvey published his treatise on generation; and afterwards engaging in the practice of midwifery, published his *Exercitatio de partu*. Some notice is also taken by Sydenham of the diseases incident to child-bed women, and of those of young children. About this time several other tracts on subjects relating to midwifery appeared, by Wharton, Charleton, Mayow, &c.; but till about the year 1634, Dr Denman considers the treatise of Raynold already mentioned as being the standard. The appearance of the works of Ambrose Paré, which were now first published, depressed the reputation of Raynold's book; and Dr Chamberlen, a celebrated physician, likewise applied himself about the same time to midwifery. He introduced an instrument into the art called a *forceps*, but which Dr Denman supposes to have been a *vectis*.—He had three sons who likewise practised midwifery, and, as well as himself, obtained considerable character; and one of the young men went over to Paris with a view to sell the secret, or advance his fortune by a practice which he had found so successful in England. In this, however, he was disappointed; the first case in which he was engaged proved unsuccessful, and he suffered much reproach in consequence. Returning to England, therefore, in 1672, he published a translation of Mauriceau's midwifery, which continued in great estimation for many years.

Dr Willoughby, who wrote a treatise on midwifery, quoted in manuscript by Dr Denman, complains of the practice of midwives about this time. He says, that the books upon the subject all copied one another, recommending methods which could not but be prejudicial to the woman; and that particularly they did not attend to the efforts of nature, but endeavoured to force the birth before the proper time. He was the grandson of Sir Francis Willoughby, so much celebrated in the time of queen Elizabeth; and Dr Denman is of opinion, that the fame and fortune acquired by Dr Chamberlen, induced so many gentlemen as now practised midwifery to undertake the study of it, and to make use of instruments as he did. Among these was Dr Bamber; but others attempted to raise their reputation by a quite contrary practice. In 1723, Dr Maubray published a book on midwifery, intitled, *The Female Physician, or the Whole Art of New improved Midwifery*, in which he violently declaims against the use of instruments; and next year he published an appendix, under the title of *Midwifery brought to perfection*, in which he sets forth in a pompous manner the improvements he had made. This, however, was no more than a syllabus of his lectures, he having been the first public teacher of midwifery in Britain.

Dionis's midwifery made its appearance in 1719, and Deventer's in 1729. The latter, in Dr Denman's opinion, was more esteemed than it deserved, as he generally condemns the use of instruments; notwithstanding which, he thinks it a considerable acquisition to the science in this country.

In 1727 appeared Dr Simson's work, intitled, *The System of the Womb*; "a work (says Dr Denman) of sufficient ingenuity, but not of much use in practice, even if his theory had been true." Chapman's *Treatise on the Improvement of Midwifery* appeared in 1733. He was the second public teacher of midwifery in London, and was the first who described the *forceps*; the description appearing in the third volume of the Edinburgh Medical Essays. His work contains many useful observations. Next year Dr Hody published a collection of cases in midwifery, written by Mr William Giffard. They are 275 in number, occurred in his own practice, and appear to be written with great fidelity. He also gave a plate of the forceps; and, in Dr Denman's opinion, was among the first who asserted that the placenta might be attached over the *os uteri*. In 1736, Thomas Dawke published a book, intitled, *The Midwife rightly Instructed*; and, the following year, *The Midwife's Companion*, By Henry Bracken: but these, as well as some others which made their appearance about the same time, are of no importance.

About the same time also, Sir Richard Manningham quitted the profession of pharmacy, and applied to the study and practice of midwifery. He had received the honour of knighthood in 1730; and in 1739 he established a small hospital or ward for lying-in women, which was the first thing of the kind in the British dominions. Here also he gave lectures; and at the same time qualified his students for practice. He became very eminent in his profession, which he exercised with great humanity, and was accounted a man of great learning. He published a work, intitled *Compendium Artis Obstetricæ*; and another, called *Aphorismata Medica*, relating also chiefly to the art of midwifery. In 1741, Sir Fielding Oulde of Dublin published *A Treatise of Midwifery*; the most important parts of which are some observations on the continuance of the thickness of the uterus during pregnancy, with his description of the manner in which the head of the child passes through the pelvis at the time of the birth; the truth of which observations have since been universally ackowledged.

From this time the English, according to Dr Denman ‡, might be said "to have been in full possession of the subject; all the books written in the neigbouring countries being translated, public lectures given, and an hospital established for the further improvement of the art: and as all the books printed since that time may readily be procured, every gentleman has an opportunity of forming his own opinion of their respective merits. But the college of physicians (adds he), having

‡ Introduction to the Practice of Midwifery, preface.

having been pleased, in the year 1783, to form a rank in which those who dedicate themselves to the study of midwifery should be placed, I trust that future accounts will be more correct; and that this measure adopted by the college will promote the public benefit, by confining the industry and abilities of one class of men to this branch of the profession."

In Scotland, though there has for a long time been professors of midwifery, yet the surgeons likewise practise that art as well as their own. Several approved treatises on the subject have appeared in this country; particularly a system by the late Dr Smellie, which has been long held in the highest estimation in both kingdoms; and within these few years, several excellent performances by Dr Alexander Hamilton of the university of Edinburgh: And indeed, we may venture to affirm, that both theory and practice of midwifery are as well understood in this kingdom as in any part of the world.

PART I. THEORY OF MIDWIFERY.

Description of the Pelvis in general.

THE subject of this Part comprehends, in a particular manner, the anatomical structure of the pelvis, and other parts concerned in the formation of the child, the theories of conception, generation, &c. of the nutrition, growth of the fœtus, and of the powers by which it is expelled. Of all these some account has been given under other articles; but as the particular description of the pelvis belongs peculiarly to this subject, we shall here give an account of its various conformations, as they in a great measure affect women at the time of child-bearing, and very particularly contribute to the ease or difficulty of the labour.

CHAP. I. *Description of the Pelvis in general.*

Dr DENMAN observes, that the term *pelvis* has been applied indiscriminately to the inferior cavity of the abdomen, and to the bones which form that cavity; but he thinks it most proper to confine it to the bones, and to distinguish the hollow by the name of the cavity of the pelvis. In the state of infancy, the pelvis is composed of five or six bones, most of which in the fœtus are soft and flexible; some of them being, in a manner, quite cartilaginous; while the edges of others are found covered with a substance of the same kind. This construction is thought by some to facilitate delivery, as the pelvis of the fœtus can thus change its figure like the cranium; but M. Baudelocque thinks this an erroneous opinion, "consonant neither to reason nor experience."

In the adult the pelvis consists only of four bones, viz. the *sacrum*, the *os coccygis*, and the two *ossa innominata*. These being already described under the article ANATOMY, we shall here content ourselves with observing, that an anchylosis is not unfrequently formed between the os sacrum and the ossa innominata; and sometimes an imperfect joint in consequence of their separation; whence the part is very much weakened, and the person ever afterwards walks with difficulty.

The os coccygis in infancy is cartilaginous; but in the adult it is composed of three, or more frequently of four bones, connected by intermediate cartilages, the uppermost of which is somewhat broader than the lower part of the os sacrum. In some subjects these bones coalesce, and form a single one: in others an anchylosis is formed between the sacrum and os coccygis; in consequence of which the latter is shortened and turned inwards, so as to obstruct the head of the child in its passage through the pelvis. But the impediment thereby occasioned at the time of labour may be overcome by the force with which the head of the child is propelled, and the os coccygis again separated from the sacrum with a noise loud enough to be distinctly heard. In general, however, some regressive motion is preserved between the bones of which the os coccygis is composed; and that which is produced between the *sacrum* and *os coccygis*, when the latter is pressed by the head of a child passing through the pelvis, occasions a considerable temporary enlargement of the inferior aperture of the pelvis. Any lateral motion is prevented by the insertion of the *coccygæi* muscles, part of the *levatores ani*, and some portions of the sacro-sciatic ligaments into the sides of the *os coccygis*.

The *os innominatum*, in a woman of the ordinary size, is about six inches broad from the anterior to the posterior superior spine. The height is nearly six inches and an half from the anterior spine to the bottom of the tuberosity of the ischium, and seven and an half if taken from the middle of the crista of the ilium; and hence we may in some measure be enabled to determine the depth of the cavity of the pelvis laterally from the superior to the inferior strait.

"The ossa pubis (says M. Baudelocque †) are joined together by means of a substance which has always been described by the name of cartilage, though it differs as much from that as from a ligament. According to some anatomists, each *os pubis* is covered by its own cartilage. Their junction not a true synchondrosis; but a close articulation, which admits only of insensible motions. By carefully examining this symphysis, we observe that each os pubis is really covered by a cartilage at its anterior extremity; that this cartilage is thicker before than behind, and in its superior and inferior parts than in the middle of its length; that these bones, thus covered, are bound together by means of a substance which seems ligamentous, and whose fibres, which are mostly transverse, go from one to the other; that these fibres are so disposed, that the deepest are the shortest, and the most superficial the longest; that they leave between one another a kind of meshes filled with reddish corpuscles, very like those which are seen about the moveable articulations, and which are commonly thought to be synovial glands. We observe farther, that this fibrous and ligamentous substance does not occupy the whole thickness of the symphysis, and does not bind the bones together through the whole extent of the surfaces presented by their anterior extremities; but that there exists a true articulation of the species known by the name of *arthrodia*. If we open this symphysis towards the inside of the pelvis, after a cellular tissue very thin and loose, which we meet with first, we discover a capsular membrane, whose most apparent fibres are transversal; afterwards

† System of Midwifery translated by Mr Heath.

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terwards two cartilaginous facettes, smooth, polished, and moist, from six to eight lines long and two broad, of a figure a little semilunar, lightly convex on one bone and concave on the other. These facettes comprehend nearly the middle third of the length of the symphysis and the posterior third of its thickness.—This symphysis then presents in one third of its extent, or thereabouts, a true articulation; and in the rest a *syneurosis* and *synchondrosis* at the same time.

"This compound and articular substance, being detached from the bones, forms a kind of wedge, whose base constitutes the anterior part of the symphysis, and its edge the posterior; so that these bones seem to touch towards the inside of the pelvis, and appear separated to the distance of several lines without: The base of this kind of wedge is generally from four to six lines broad towards the middle of the length of the symphysis, and from eight to ten in the inferior and superior parts, while the edge at most does not exceed one line. Its thickness, taken according to that of the bones, is greater above than below; where this substance, become thinner, forms what is called the triangular ligament.

"This first means of union was not sufficient to give these bones the firmness necessary for the free exercise of the functions to which the pelvis is destined. It is covered and fortified in all parts, but especially before, by bundles of ligamentous and aponeurotic fibres. Independently of the thick and very strong ligamentous structure which forms the fore-part of the symphysis, we observe bundles of tendinous fibres which decussate each other a thousand ways, some of which arise from the interior *graciles* and the external *obturators*, and others from the external portions of the inguinal rings. The triangular expansion which terminates the symphysis inferiorly, and which forms the top of the arch of the pubes, seems to have other uses than that of binding the bones together.

"The manner in which the *os sacrum* is connected with the *ossa innominnata*, differs considerably from that in which the *ossa pubis* are joined. Here each articular facette is covered by a true cartilaginous layer, and there are inequalities on each side, which mutually receive one another, while nothing of that kind is observed in the junction of the pubes; neither are there in any part of these articular facettes any of the transverse fibres which go from one bone to the other in the *ossa pubis*: these articulations, therefore, derive all their strength from the great numbers of ligaments which surround them. Most of these are very short, and do not extend beyond the edges of the articular facettes: but there are others longer to be seen above, below, and behind these symyhyses.

"The *os sacrum* is not only articulated with the ilia, but with the spine and coccyx. It is joined in three places to the spine: 1. By an oblong and cartilaginous impression in the middle of the basis, which unites it to a similar impression in the body of the last *lumbar vertebra*, by means of an elastic substance. 2. By two little articular masses fixed in the posterior edge of that first impression, and which answer to similar substances in the vertebra abovementioned.

"The elastic substance which unites the middle of the base of the sacrum to the spine, is entirely similar in its nature to that seen between the bodies of all the vertebræ. Being very thick before and thin behind, the angle resulting from the disposition of the articular facettes of these two parts is rendered more obtuse. This *sacro-vertebral* junction is surrounded by an infinity of ligaments, some without and others concealed within the spinal canal. All motion is not prohibited by this kind of junction; but, as it only depends on the compression of the intermediate substance, it can be but very small. The motion between the body of the last lumbar vertebra and the base of the sacrum, is never extensive enough to make any alteration in the degree of acuteness of the angle which results from their junction; but the convexity of the lumbar column may be augmented or diminished by means of a compound motion, formed of those which take place between each of the lower lumbar vertebræ and between the lower ones of the back. This augmentation or diminution of the convexity, in proportion as the trunk is bent backward or forward, or by raising or lowering the breech when the woman lies on her back, deserves particular attention in the practice of midwifery; for thus we may make a favourable change in the direction of the axis of the pelvis, relatively to that of the trunk, to that of the uterus, and in the direction of the expulsive forces of the latter, which may be rendered more or less efficacious according to circumstances, by making the woman preserve a proper attitude.

"The junction of the coccyx with the sacrum permits the former to move, and yield to the different degrees of pressure it undergoes in different circumstances. The mobility is very great in youth; but diminishes insensibly as the patient grows older, and at last is totally lost. If entirely lost, or considerably diminished, before a woman is past child-bearing, it produces sometimes, though very rarely, an obstacle to delivery. The connections of the pelvis with the inferior extremities are not of much importance in midwifery. The natural course of labour cannot be disturbed by any fault in their configuration when the pelvis itself is well formed; but in general they are consequences of a deformity of it. They are *enarthroses*, which allow of motion in every direction."

The pelvis is divided into two parts, called the *upper* and *lower*, by a ridge sometimes elliptical, and sometimes of other shapes. The breadth of the upper part from the anterior superior spine of one ilium to another, is usually eight or nine inches, and its depth from three to four. At the back part of it is the projection of the lumbar vertebræ, and at the sides the *iliac fossæ*. The lower part forms a kind of canal, whose entrance and outlet are somewhat narrower than the middle; whence it has been distinguished into the *superior* strait, the *inferior* strait, and an excavation.—The *superior* strait is a kind of circle forming the entrance of the canal: its form, however, is various, as is also its obliquity from behind forwards. M. Levret has fixed this last at an angle of from 35 to 40 degrees.

The smallest diameter of this strait is generally about four inches, extending from the middle of the projection of the sacrum to the superior and internal part of the symphysis of the pubes. The other diameter

Description of the Pelvis in general.

diameter is usually about an inch longer, extending from one side of the strait to the other. The oblique diameters are a medium betwixt the two former, extending diagonally from each acetabulum to the sacro-iliac junction of the opposite side. The pelvis is cut at right angles by the two former, and into acute ones by the latter; but the diameters, considered in relation to delivery, are somewhat different from those just mentioned, some changes in them being occasioned by the soft parts within the pelvis.

The inferior strait is in general smaller, and of a more irregular figure than the other, being not formed like it entirely of bones. The edge, rendered unequal by three deep and large notches, is completed behind and at the sides by the sacro-ischiatic ligaments, forming a kind of circular notch before, called the *arch of the pubes*. The diameters of it are commonly about four inches in length; and though the transverse, which extends from one *ischium* to the other, be often a little longer than that which extends from the fore to the back part, it must be reckoned the smallest with regard to delivery; because the latter augments in proportion as the point of the coccyx recedes from the pubes. We must also remember, that the great diameter of the inferior strait is parallel to the smallest of the superior, and that it crosses the longest of that strait at an angle more or less acute; and by carefully attending to this, we may, in many cases, with the finger alone, when properly directed, remove obstacles which could not have been overcome even by means of instruments, without exposing the child to great inconveniences. It is likewise favourable to delivery that the middle part of the pelvis is a little larger from before backwards than the straits; which disposition proceeds from the curved figure of the *os sacrum*.— On one side this curve diminishes the numerous and long-continued frictions which the child's head would necessarily undergo if the pelvis were equally broad in all its parts; and on the other side it is equally useful in preventing the effects of a long and forcible pressure on the sacral nerves, which a flat form of the sacrum would have rendered unavoidable during the whole time of the passage of the head. The cavity of the pelvis is commonly from four to five inches deep behind, three and an half at the sides, and one and an half at most before.

The arch of the pubes, which at the top is only from one inch and a quarter to one and two-thirds in breadth, augments gradually as it descends; so that at the bottom its sides are three inches and an half, or even four inches, separated from one another; that is, if we take the line which is looked upon as the transverse diameter of the inferior strait for its base; the height being about two inches.

The axis of the superior strait of the pelvis cannot well be determined; but that of the inferior one, with regard to delivery, must be considered as passing through the centre of the opening of the vagina dilated by the child's head. Its direction is then so much inclined from behind forward, that its superior extremity traverses the lower part of the first false vertebra of the sacrum, and crosses that of the other strait at a very obtuse angle.

Hitherto we have treated only of that form of the pelvis which is most favourable for delivery; but the proportions and forms of it are various; and as it differs from those above described, the delivery is attended with more or less difficulty.

The defects of the pelvis, with regard to facility of delivery, consists in its being either too large or too small. At first sight it might be imagined, that a large pelvis, would make the delivery more easy, as the head of the child will thus be exposed to fewer frictions, be more easily expelled, and the labour be less painful. But women who have a very large pelvis, are subject to those inconveniences which arise from on obliquity of the uterus, or even to a descent of it altogether; especially in the time of labour, when that viscus, being already charged with the weight of the child, is entirely subjected to the expulsive power of the abdominal muscles. In women who have had several children, the uterus is but weakly retained by its ligaments; and in subsequent pregnancies it descends still lower, until at last it rests on the margin of the pelvis. This, however, does not take place before the conclusion of the first four or five months: before that time its weight lies principally on the extremity of the rectum; and by this, as well as by its bulk, the discharge of the urine and fæces is impeded, and accidents sometimes ensue from the compression of the veins which pass through the pelvis. These symptoms sometimes vanish about the middle of pregnancy, but re-appear towards the latter end; because the head of the child is early engaged in the pelvis, and acts on the same parts that the whole uterus did before. Besides all these accidents, there are others which may take place at the time of delivery; so that upon the whole, it cannot be reckoned any real advantage for a woman to have a large pelvis.

The accidents, however, which arise from too great a size of the pelvis, are much more easily remedied, and in themselves less dangerous, than such as arise from its narrowness. This defect may be considered as either relative or absolute. The former arises from an excess of size in the head of the child; the latter from a bad conformation of the pelvis itself. The absolute narrowness of the pelvis rarely affects all parts of it at once; it is generally found only in one of the straits; in which case, the other is usually of the natural size, nay, sometimes even larger than natural. The fault is more frequently in the superior than the inferior strait; and it is remarkable, that it most commonly affects the strait in its small diameter; very rarely in its tranversal; sometimes affecting only one side. In the inferior strait it is generally caused by the approximation of the tuberosities of the ischia.

" It is easy (says M. Baudelocque) to determine why the superior strait is more frequently deformed than the inferior; and why it is almost always between the pubes and sacrum that it is defective respecting delivery. If we consider the direction of the forces which act on the pelvis of rickety children, in whom the bones are at the same time softer and more loosely connected than in the natural state, we shall see that the greater part of those forces tend to carry the base of the sacrum forward and the *ossa*

Description of the Pelvis in general.

pubis backwards. Whether the child be ſtanding or ſitting, if we attend to the direction of the ſpinal column, we ſhall ſee that the weight of the body muſt inſenſibly puſh the baſe of the ſacrum towards the pubes; and that it acts in the ſame manner on the inner parts of the acetabula, which ſerve as a fulcrum to the inferior extremities when the child is ſtanding or walking. The *oſſa pubis*, particularly in theſe latter caſes, muſt be puſhed towards the ſacrum; in ſuch a manner, however that their poſterior extremities often approach a little nearer to the projection of the baſe of that bone than their anterior extremities, or the ſymphyſis. If the ſuperior ſtrait does not conſtantly preſent the ſame figure in deformed *pelviſes*; if it is ſometimes larger on one ſide than the other; if one of the acetabula is nearer to the ſacrum, while the other approaches leſs; if the ſymphyſis of the pubes is removed, in many caſes from a line which would divide the body into two equal parts—it is becauſe the rickets have not equally affected all the bones of the pelvis, nor equally hurt all their junctions; and becauſe the attitude which the child takes in walking or ſitting may change a little the direction of the compreſſing powers juſt mentioned. The weight of the body may alſo equally hurt the form of the inferior ſtrait, but variouſly, according to the moſt uſual attitude of the child and the direction taken by the ſpinal column. For example; If it ſits much, the ſacrum will be more curved, and the ſtrait more contracted from before backwards: in this attitude, if it inclines habitually to one ſide, one of the iſchiatic tuberoſities will be thrown inwards, the *os ilium* will be more elevated, &c. The action of the muſcles which are attached to the pelvis, the preſſure of cloaths, and that which the arms of the nurſe exert on this part, contribute alſo ſomething to the deformities in queſtion, but much leſs than the weight of the trunk: whence we ſee, of what importance it is to keep rickety children in bed, and leave them at liberty; inſtead of obliging them to walk, to ſit up, or have them conſtantly in the arms, as is done almoſt every where."

The dimenſions of the pelvis itſelf vary no leſs than the contour of the ſtraits. If the diameter of ſome, taken from the pubes to the middle of the projection of of the *os ſacrum*, be only a few lines; in others the defect is ſeveral inches, ſo that ſcarcely a ſingle inch is left between theſe bones. Theſe extremes, however, are not frequently met with; and the latter of them is never ſo great in the inferior as in the ſuperior ſtrait. On comparing the dimenſions of a well-formed pelvis with thoſe of a child's head, we ſhall find that the former might admit of being ſome inches leſs in circumference, and yet be large enough for an eaſy delivery. The circumference of a common head is uſually no more than ten inches and a quarter, or ten and an half. The firſt degree of narrowneſs in any pelvis therefore muſt be, when each diameter is ſomething leſs than three inches and an half. M. Baudelocque ſays, that he has ſeen pelviſes in which the diſtance of the pubes from the ſacrum ſuperiorly was no more than ſix or eight lines; and he had in his poſſeſſion two others, in one of which the diſtance from the back of the right acetabulum to the projection of the ſacrum was only three or four lines, and the other had but 14 lines between that projection and the ſymphyſis of the pubes.

The narrowneſs of the pelvis is to be acounted one of the principal cauſes of difficult delivery.—When an opening of only three inches and a quarter is left, the labour muſt be more difficult than when it is three inches and an half, as the number of frictions which the child's head muſt undergo are then more numerous and frequent. When there is an opening only of three inches, the labour muſt be ſtill more difficult; but ſtill there are inſtances of natural deliveries without any aſſiſtance, notwithſtanding the diſproportion betwixt the ſize of the child's head and pelvis. This may even happen when the diameter of the pelvis is ſtill ſmaller, ſuch as two inches and three quarters, or two and an half. M. Solayres obſerved in a caſe of this kind, that the head was lengthened in ſuch a manner, that its longeſt diameter was eight inches all but two lines, that which goes from one parietal protuberance to the other being reduced to two inches five or ſix lines; and M. Baudelocque has obſerved ſimilar changes in the form of the head, and the reſpective lengths of its diameters at the inſtant of birth, where the child was equally deformed, the long diameter being ſeven inches, and the tranſverſe one two inches ſix or ſeven lines. The children were in good health; and the day after their birth their heads wanted very little of the uſual proportions.

But when the ſmall diameter of the pelvis is leſs than two inches and an half, the head of the child cannot paſs; and then ſome of the dangerous chirurgical methods muſt be undertaken, which frequently prove fatal both to the mother and child. Even when the pelvis is two inches and an half in diameter, the natural delivery is not always without danger to both; as, on one hand, the ſoft parts which cover the pelvis are ſubjected to ſuch violent preſſure that they become inflamed, exquiſitely painful, and at laſt are even threatened with gangrene; on the other, the bones of the child's cranium riding over one another, or ſometimes fractured and depreſſed, wound the brain, and produce internal extravaſations which generally prove fatal. The bad conſequences reſulting from a deformed pelvis, ſhow themſelves ſooner or later, according as the ſuperior or inferior ſtrait is vitiated. When both are ſo, the obſtacles to the birth begin to manifeſt themſelves as ſoon as the labour begins: and ſometimes thoſe at the ſuperior ſtrait are ſo great that the expulſive powers are exhauſted, and the head ſtops there; or if it be puſhed farther into the pelvis, and ſtopping there, it will remain incapable of being delivered without the aſſiſtance of art. The head cannot paſs this ſtrait without being in a conſiderable degree elongated; and when it enters the pelvis, the cavity being there ſufficient for it, it naturally returns to its former dimenſions, at leaſt in part, and more or leſs ſo as it ſtays a longer or ſhorter time. The ſame conformation of the head, however, which enabled it to paſs the firſt ſtrait, is ſtill more neceſſary to enable it to paſs the ſecond: and hence the ſymptoms which had come on with the firſt pains, ſometimes diſappear in a great meaſure during the time that the head ſtays in the excavation; but increaſe to

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a greater degree than ever when the ſtrong labour comes on.

When the ſuperior ſtrait alone is contracted, the head advances at firſt with great difficulty; but as ſoon as the parietal protuberances have cleared the ſtrait, the other parts of the pelvis being relatively or abſolutely larger, the head paſſes them with ſo much eaſe, that the delivery is frequently terminated by a few pains. The contrary is obſervable when the fault is in the inferior ſtrait, if the firſt be of the uſual ſize. The head then deſcends eaſily into the lower part of the pelvis; but cannot proceed any farther, until it overcome the obſtacles which obſtruct its courſe, and render it difficult and laborious. In this caſe, the ſymptoms attending obſtruction appear later than in the former. In theſe caſes, however, it is neceſſary that the practitioner ſhould accuſtom himſelf by practice to form a juſt eſtimate of the powers of nature, otherwiſe he may eaſily deceive himſelf; in the former, ſuppoſing that a delivery is impoſſible; and in the latter, that a delivery will be eaſy which cannot be effected without the aſſiſtance of art. An inſtance of this is given by our author, in a caſe to which (he ſays) more than forty perſons were witneſſes.

The operator pronounced that the woman would be ſpeedily delivered, on account of the facility with which the child's head had engaged with the firſt pains; and attributing the obſtacles which ſoon after obſtructed its courſe to another cauſe, raſhly deſtroyed the child by uſing the crotchet, when its life might have been preſerved by other means, having waited two days in blind ſecurity, expecting a natural delivery. M. Baudelocque obtained poſſeſſion of the pelvis of this woman after ſhe died; and tells us, that the circumference of the ſuperior ſtrait of the pelvis, when diveſted of all its coverings, meaſured 14 inches, but the inferior only *nine*. The diſtance from the point of the os ſacrum to the ſymphyſis of the pubes, as well as the interval between the iſchiatic tuberoſities, was but three inches. The cavity of this pelvis diminiſhed inſenſibly in breadth from one ſtrait to the other, and was as regular as poſſible in its contour.

The excavation, or middle part of the pelvis, is much more ſeldom defective in its form than the ſtraits; and when this is the caſe, it muſt ariſe from ſome exoſtoſis, or from the ſacrum deſcribing a right line in its anterior part, inſtead of being curved as uſual. The ſtraight and flat form of the ſacrum generally produces fewer obſtacles to delivery than the too great curvature of it. The former fault generally affects only the cavity of the pelvis, and cannot hinder the paſſage of the child, if the canal be otherwiſe well diſpoſed: but the latter, or too great a curve of the ſacrum, commonly proves injurious to both ſtraits, contracting them from before backwards, and at the ſame time diminiſhing the depth of the pelvis at the back part, as well as the reſpective height of the arch of the pubes. In theſe caſes the head, though it paſſes the firſt ſtrait with difficulty, cannot paſs the ſecond; being ſtopped in its courſe by the inferior part of the ſacrum before the occiput is long enough to engage under the arch.

Labours may alſo be rendered difficult by too great a length of the ſymphyſis of the pubes; a want of elevation, or breadth of the arch of theſe bones; the length and wrong direction of the iſchiatic ſpines, as well as a conſolidation of the coccyx with the point of the ſacrum. Theſe faults, however, are very rare, if we except the conſolidation of the coccyx: they are ſcarce ever met with alone, and are generally the conſequences of a bad conformation of the reſt of the pelvis. Even this conſolidation, however, though more common than the other faults, yet cannot obſtruct delivery ſo frequently as has been imagined; and when it does ſo, it is only in women who have a narrow pelvis. Our author denies the poſition laid down by ſome, that the head of the child, in all caſes, puſhes back the point of the coccyx half an inch, or even a whole inch. Thoſe who aſſert this (he ſays) know not the relation betwixt the dimenſions of the head and the inferior ſtrait in moſt women. Whence he cannot recommend a precept founded upon this principle, by which it is directed to puſh back the coccyx, when the head, though low down, cannot diſengage itſelf eaſily.

We muſt now conſider a ſubject on which the writers upon midwifery have been greatly divided, viz. the ſeparation of the bones of the pelvis in the time of labour. Some have imagined that this ſeparation took place in all labours; others that it happened only in difficult caſes; ſome, that it indicates a morbific ſtate; and ſome that it was quite impoſſible.—M. Baudelocque allows the poſſibility of ſuch a ſeparation, but denies that it happens ſo frequently as is imagined. "Experience (ſays he) demonſtrates, that this ſeparation, far from being common, is very rarely met with, and is not more uſual after a laborious than after an eaſy labour, nor in a diſtorted pelvis than in one well formed. I have ſought for it twenty times in all theſe caſes, by opening the bodies, and have ſcarcely met with one which could remove all doubt of its exiſtence." In thoſe caſes where it takes place, he is of opinion, that the filtration of ſerum into the ligamentous tiſſue of the ſymphyſis, muſt be regarded as the uſual prediſpoſing cauſe. The remote cauſe, of conſequence, muſt be whatever produces this filtration. This, he thinks, cannot be done merely by the preſſure of the gravid uterus on the trunks of the veſſels which are diſtributed to theſe ſymphyſes. An alteration in the fluids themſelves he ſuppoſes likewiſe to be neceſſary.

But though the prediſpoſing cauſe of this ſeparation muſt be the relaxation of the ſymphyſes by the infiltration of ſerum, we are not to look upon the ſwelling of the cartilages by means of this infiltration to be the immediate cauſe: For however the ligaments may be relaxed, the cartilages which incruſt the extremities of the oſſa pubis, as well as the articular facettes of the oſſa ilia and the ſacrum, are no thicker; ſo that they cannot, as ſome have ſuppoſed, act like wetted wedges by which large blocks of ſtone may be cleaved. "The wedge by which the bones of the pelvis are ſeparated (ſays our author), does not act between the extremities of theſe bones, but in the circle formed by their aſſemblage in the pelvis itſelf: it is the uterus charged with the produce of conception

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tion in the latter periods of pregnancy, and the child's head forced down by the action of the uterus, and of the abdominal muscles in time of labour."

This separation, however, is not always the effect of a relaxation and stretching of the ligamentous tissue of the symphysis. In some cases, where the obstacles which obstruct the passage of the child are very great, and the efforts for its expulsion very strong and lasting, the symphyses tear, and permit the bones to separate much farther than they could have done by a simple relaxation. "I must add (says our author) that it is not the symphysis of the pubes, properly speaking, which tears; for no effort can break the ligamentous substance which unites these bones to each other; the symphysis detaches itself from one of them, and leaves the bone naked." The separation in question has likewise frequently taken place in instrumental deliveries, to which the natural efforts seemed to contribute nothing; and it has also been found in consequence of a stroke or fall.

"Being deceived in the principle of this separation (says M. Baudelocque), they necessarily erred in the consequence deduced from it. It has been so firmly believed to take place in all labours, that it was thought to be absolutely necessary; and that without it many women could not be delivered without extreme difficulty. Having thus mistaken the necessity and pretended advantages of this separation, the natural resistance of the symphyses, and above all the dryness and rigidity necessarily induced in them by age, were consequently reckoned among the causes of difficult and laborious births. Obstacles have been attributed to the state of these symphyses, which merely depended on the resistance of the neck of the uterus, and of the external parts; and it has been recommended to moisten and relax them by the use of baths, cataplasms, liniments, fomentations, &c. But what can be expected from such methods, when delivery is obstructed by a narrow pelvis? Will any one venture to assert, that he has once by such means obtained the effect he expected, and that he has thus assisted labours which could not otherwise have been terminated but by the Cæsarean operation, as has so often been published? I should have dispensed with demonstrating the fallacy which has prevailed on this point, if it had not led some practitioners into a very serious consequence. In order to appretiate all these means, and fix the degree of confidence to be placed in them, supposing that they could operate to the relaxation of the symphysis of the pelvis, it is necessary to determine what degree of amplitude can be given to that cavity by the separation of the bones which constitute it. The ossa pubis cannot separate without augmenting the circumference of the pelvis; but how much will its diameter be increased? If the circumference were perfectly circular, every possible diameter would partake a third of that augmentation; but as the entrance of the pelvis is in general the more elliptic as it deviates more from its natural state, it follows, that its different diameters cannot increase in the same proportion; and we may say that there is none but the transverse one which can become larger. In a moderate separation the *antero-posterior* diameter is scarce at all augmented; and it has been repeatedly demonstrated, that the ossa pubis must separate at least an inch to procure two lines in that direction; while the transverse diameter shall be increased six lines, and often more.

"The pelvis being larger in most women than is necessary for their delivery, the separation of the bones could be of no advantage to them, nor render their delivery more easy. Far from regarding it, with some ancient authors, as a benefaction of nature, we ought to consider it as an additional source of inconveniences in those women who are subject to it; for, on one side, we see that a pelvis too large exposes the woman to a number of accidents; and on the other, that there are some which inevitably accompany the separation, and the mobility of the bones which form that cavity. Far from favouring delivery in all these cases, it could not but render it more tedious and painful to the woman, as experience has convinced me. If we ought to expect any real advantage from it, considering it only with respect to the passage of the child, it could only be in those women who have the pelvis deformed, and where the defect which rendered delivery impossible did not exceed two lines at the most; since a separation of an inch cannot procure an augmentation of more than two lines in the small diameter of the superior strait, which is almost always that which occasions the greatest obstacles to the exit of the child. If from a separation of an inch, which has never taken place between the ossa pubis without a rupture of their symphysis, we are not to expect an augmentation of more than two lines in the direction of the little diameter of the superior strait, what can we obtain from a separation always much less, and so little apparent in most women that we may doubt its existence? The examination of a great number of women who have died in child-bed has proved to me that it is excessively rare for the separation in question to amount to two lines; and I never found it exceed that but once. But supposing (what is impossible) that art could procure a separation of an inch between the ossa pubis without dividing their symphysis, what practitioner would dare to affirm without fear of being deceived, that the volume of the child's head did not exceed the little diameter of the superior stait by more than two lines? If it is difficult to estimate justly the degree of opening in the pelvis, it is much more difficult still to judge of the child's head; and it is only by taking the mean between the largest and the smallest that we usually establish the relation of its dimensions to those of the pelvis; but a *thereabouts*, in the case supposed, cannot supply the place of that precision which would be necessary."

From his reasoning upon this subject, M. Baudelocque concludes directly against the operation of cutting the symphysis of the pubes, as being not only useless, but attended with very dangerous consequences. "When this separation (says he) has been suddenly made, severe pains in the parts divided, an impossibility of walking, and sometimes even of moving the inferior extremities, inflammation, fever, abscesses, caries, and lastly death itself, have generally been the effects of it; but when a relaxation only takes place, the consequences are less severe; a painful and tottering walk being the only symptom attending it. If the relaxed symphysis at last grow firm again, if the bones of the pelvis recover their former stability, if the

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the lameness goes off entirely in some women, how often, on the contrary, have we not observed an inability to walk, or even to move the legs, without violent pain, continue for years afterwards:"

These violent symptoms frequently attend even slight separations of the bones in question. M. Baudelocque gives an instance of a woman who had kept her bed ten months, being all that time afflicted with the most excruciating pains in the junction of the ossa pubis, and of one of the ilia, with the sacrum, whenever she attempted to move the inferior extremities, though no separation of the symphysis could be discovered, nor any thing besides a slight mobility in that of the pubes. The accident had been perceived during the time of labour, and the midwife had been accused of luxating the bones.

Dr Denman has also treated this subject at considerable length. He informs us, that for many centuries it was believed that these bones were always separated during the time of labour; or that there was a disposition to separate, and an actual separation, if the necessity of any particular case required that enlargement of the cavity of the pelvis which was consequent to it. The degree of separation was also supposed to be proportioned to such necessity; and when this did not happen naturally, instruments were made use of for distending the parts: and, on the same principle, the section of the symphysis of the pubes has been recommended. "This opinion (says he) ought probably to be assigned as one reason for the superficial notice taken by the early writers on midwifery of those difficulties which are sometimes found to occur in parturition from the narrowness or deformity of the pelvis. To this may also be referred much of the popular treatment of women in child-bed, and many popular expressions in use at present. But this opinion has been controverted by many writers, who assert, that there was neither a separation nor a disposition to separate; but that when either of them did happen, they were not to be esteemed as common effects attendant on the parturient state, but as diseases of the connecting parts. The disputants on each side have appealed to presumptive arguments, and to facts proved by the examination of the bodies of those who died in child-bed, in justification of their several opinions. But notwithstanding all that has been said, I know not that we are authorised by the experience of the present time to say, that a separation, or a disposition to separate, prevails universally at the latter part of pregnancy, or at the time of labour: yet that these effects are often, if not generally produced, may be gathered from the pain and weakness at the parts where the bones of the pelvis are joined to each other before and after delivery. In some cases also pregnant women are sensible of a motion at the junction of the bones, especially at the symphysis of the ossa pubis; and the noise which accompanies it may sometimes be heard by the bystanders.

"A strong presumptive argument in favour of the separation of the bones has been drawn from quadrupeds. In these the ligaments which pass from the obtuse processes of the ischia to the sacrum, on which the firmness of the junction of the bones very much depends, and which at all other times resist any impression attempted to be made upon them, are for several days previous to parturition gradually deprived of their strength, and the animal walks in such a manner as would incline us to believe could only be produced by a separation of the bones of the pelvis. Now it is not reasonable to conclude, that a circumstance which generally takes place in one class of viviparous animals should never occur in another, especially in a matter in which there is not essential difference."

Notwithstanding these arguments, however, Dr Denman does not look upon the matter to be yet absolutely decided. No person, he says, who has been conversant in the dissection of women who have died in child-bed, can have wanted opportunities of seeing every intermediate state of these parts, from a separation in which the surfaces of the bones were loosened and at a considerable distance from each other, to that in which there was not the least disposition to disunite.

When this separation takes place beyond a certain degree, it is to be looked upon as morbid: and, he says, that it may be produced by the two following causes. "*1st*, A spontaneous disposition of the connecting parts. *2dly*, The violence with which the head of the child is protruded through the pelvis." Of each of these cases he gives an example.—The first was of a young lady of a healthy constitution, who had been married in the 21st year of her age, and in 1774 was delivered of her third child, which was unusually large, and the labour was severe and tedious. For several days before delivery she had been so much afflicted with pain and weakness in her loins, that she could not walk without assistance. She recovered without any unfavourable circumstance, excepting that for several weeks she was incapable of standing upright, or putting one foot before the other; the attempt to do either being attended with pain and a sensation of looseness and jarring, both at the parts where the ossa innominata are joined to the sacrum, and at the symphysis of the ossa pubis. By the use of strengthening medicines she recovered, and in a few months was perfectly well."

It being suspected that the complaints abovementioned had proceeded from too frequent parturition, she was advised to suckle her child for a longer time than usual; and accordingly continued a nurse for 15 months. Soon after this she became with child a fourth time. The complaints which had accompanied her former pregnancy now came on sooner, and with greater violence than before, insomuch that for three weeks before delivery she could neither walk nor stand; and there was reason to suppose that the bones of the pelvis were separating. She was delivered on the 7th of July 1777, the labour being accompanied with faintings, great irritability, and a total inability to move her inferior extremities. A few days after her delivery she had a fever, which terminated in an abscess in one of her breasts, by which she was confined to her bed for near seven weeks. In nine weeks she could walk with crutches, and received considerable benefit by being sent into the country; and likewise, as she imagined, by drinking half a pint of infusion of malt twice a-day. In about five months she was able to walk without assistance; though sometimes sensible

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of the motion of the bones, which seem never to have been perfectly united.

About Christmas the same year, this lady became again pregnant; and in the month of July 1778 she began to feel an inability to move; which, however, was attributed to the heat of the weather: but on a sudden the pain and weakness of her back returned to such a degree, that she could walk no more till the 11th of October, when she was delivered of a fine child, but after a most severe and tedious labour, occasioned in a great measure by her being totally unable to move. The symptoms after her delivery became very extraordinary and alarming. On the fourth day a fever came on; and though this was soon removed, the pain at the junction of the bones still continued. She had no command of her inferior extremities; and the pain when she was moved, became so excruciating, that she felt as if tearing asunder. Her stomach was at all times much disturbed; but when the pain became violent, a nausea, vomiting or hiccough came on. Strange sympathies were produced in various parts; as a teasing cough, sneezing, sense of weight in her eye-lids, which could not be kept open though there was no inclination to sleep. There was a noise in the bowels, and other nervous affections, all of which ceased when the pain was allayed by opiates.

Having remained for several months in this deplorable situation, it was at last thought proper to raise her from her bed, and cause her to make an effort to stand or walk, lest her complaints should be made worse by such a long course of inactivity. She had now, however, totally lost the power of supporting herself; the motion of the bones was plainly perceived; and the consequences of every trial were so painful, that there was a necessity for desisting. In 1779 she was removed, upon a couch, in a boat to Margate, for the benefit of the air and sea-bathing, from which she was always sensible of receiving advantage. In this place she continued to reside; and in *eight years* after her delivery became able to walk without crutches.

The second case was of a young woman of a healthy but delicate constitution, who was in labour of her first child. The pains were so strong, that the head of the child was forced through the external parts, and the perinæum supposed to be lacerated, in spite of all the opposition which could be made. At the instant when the head of the child was expelled, the operator perceived something to jar under his hand, and was even sensible of a noise, which he attributed to the laceration of the perinæum. In a little time the placenta was extracted without hurry or violence; and a few drops of *tinctura opii* were given to allay the uneasiness which took place, and was supposed to be occasioned by *after pains*. On the following days, however, she complained of an uneasiness in the region of the abdomen; but no particular notice was taken of it, as the milk was regularly secreted, and there was no symptom of fever; but on the fourth day, when taken out of bed, she was found to be unable either to stand or sit on her chair by reason of the pain and weakness in the part of which she originally complained. This was afterwards conjectured to arise from a separation of the bones of the pubes; to which conjecture the long continuance of the complaint seemed to give countenance. The conjecture was founded on the positions and attitudes in which the patient sought to find relief. The symptoms were as follow.—When she endeavoured to stand upright, which she could do better upon one foot than both, and with her feet close than at a distance, together with the pain at the symphysis, she had a sense of extreme weakness, accompanied with a faintness. When she first sat down on her chair, resting her elbows upon the arms, the complaints became tolerable. When she had remained a little time in this position, they again became importunate, and she supported herself with her hands upon her knees, and presently bent forwards, so as to lean her elbows upon her knees; this position becoming irksome, she was obliged to return to her bed, where she became immediately easy. When she first atttempted to walk, she was compelled to bend forwards in such a manner as to rest her hands upon her knees, making a straight line from her shoulders to her feet. At the end of 14 weeks, whilst she was in a coach, into which she had often been lifted for the benefit of air and exercise she had a discharge which she supposed to be menstruous; but which, though it ceased before her return, gave immediate relief. From this time she became better every day, and in six weeks was able to walk. She had afterwards three children, with which her labours were easy, and she never had any return of the abovementioned complaints.

From all this it is evident, that Dr Denman differs considerably in his opinion from M. Baudelocque concerning the separation of these bones. According to him, it appears that this separation, though extremely painful, does not seem to be attended with *fatal* consequences; and with regard to the *quantity* of the separation, it must undoubtedly be sometimes much greater than what M. Baudelocque supposes; for Dr Denman brings an instance from the 484th number of the Philosophical Transactions, in which the bones were separated to the distance of *four inches*. This happened in consequence of the starting of a horse when a gentleman was riding. He observes, however that, in women the violence which the connecting parts of the bones undergo when the head of the child is protruded through the pelvis with extreme difficulty, sometimes occasions an affection of more consequence than even the separation of the bones themselves. This is the formation of matter upon the loosened surfaces of the bones, preceded by great pain, and other symptoms of inflammation.

In the beginning of this complaint, it is difficult to ascertain whether the connecting parts of the bones or some of those contiguous, be the seat of the disease; but when suppuration has taken place in consequence of the injury sustained at the junction of the ossa innominata with the sacrum, the abscess has sometimes been cured by the common treatment, having formed in the neighbourhood of the injured part. At other times, when matter has been formed about the symphysis of the os pubis, hectic symptoms have ensued; and the cause of them only discovered after the patient died. In some cases the matter has burst through the capsular ligament of the symphysis at the inferior edge, or perhaps made its way into the bladder; and in

Description of the Pelvis in general.

in others in has insinuated itself under the *periosteum*, continuing its course along the pubes, until it arrives at the acetabulum. Thus all the symptoms were aggravated; and the matter making its way towards the surface, a large abscess has been formed on the inner or fore-part of the thigh, or near the hip; so that the patients have at last sunk under the fever and profuse discharge from the ulcer. On dissecting those who have died in this manner, the track of the matter has been followed from the aperture of the abscess to the symphysis, the cartilages of which were found to be eroded, the bones carious, and the adjacent parts very much injured or destroyed. Our author imagines it possible, by means of some particular symptom, to discover whether or not there be any disposition in the parts abovementioned to suppurate, or to know when suppuration has taken place. In all cases of unusual pain attended with equivocal symptoms, the parts ought to be examined with great care and attention: for where there is any disposition to suppurate, it might perhaps be removed by proper means; and when the matter is formed, if there be a swelling in the symphysis, and, more especially, if a fluctuation could be perceived, the propriety of making an incision to evacuate the matter, and prevent farther bad consequences, might be determined.

With regard to the possibility of re-uniting the bones of the pelvis after they have once been separated, our author has the following observations.

"When the connection of the bones of the pelvis has either been impaired or destroyed, it is probable that a confirmation or re-union may take place by a restoration of the original mode, by a callus, or by anchylosis. But it is likewise possible that the bones may remain in a state of separation, and an articulation be formed by the ends of each bone, at the symphysis of the ossa pubis, and at the junction of the ossa innominata with the os sacrum." Of this last the Doctor has seen one instance in a dead body, and has had reason to suspect the existence of it in some living persons. In the lower degrees of imperfection the former method of union probably takes place; as the complaints made by women of pain and weakness, after delivery, generally go off before their month of confinement is elapsed; but when they continue for a longer time, the best method is to enjoin the patient rest and an horizontal posture. In an increased degree of the complaint, where the health of the patient is affected, a longer time will be required for the recovery; but should the injury be too great to admit of the restoration of the original mode of union, a much longer time will be requisite for the formation of a callus, if this ever takes place except as a previous step to an anchylosis. This last has been observed frequently to take place at the junction of the ossa innominata with the sacrum, but never at the symphysis of the pubes. In this case little can be expected excepting from such remedies as tend to restore the constitution to its pristine vigour; and in the first case above related, the only thing from which the patient seemed to obtain relief was the cold-bath. She was likewise much assisted by the use of a swath, or broad belt, made of soft leather, quilted, and buckled with such firmness over the lower part of the body as to lessen, if not prevent, the motion of the bones; and this was kept in its situation by a bandage passed between the legs, from the hind to the fore part of the belt. But when a joint is formed between the separated surfaces of the bones, all hope of recovering the patient to her former health may be given up. The only thing which can then be done for her relief must be by the use of a belt, or some similar contrivance, to substitute, as much as possible, artificial firmness, instead of natural. Dr Denman saw one case in which he suspected this to have happened, and in which the life of the patient was truly miserable: He is of opinion, however, that it very rarely occurs; having been informed of another person, who, after eight years confinement to her bed, in consequence of the separation of the bones in the time of labour, was at last restored to the perfect use of her inferior extremities. Instances also, though rare, have occurred, in which women, after labours, have suffered much pain in the region of the sacrum, and totally lost the power of moving their inferior extremities.—This has been supposed a paralytic affection, and they are said to be bed-ridden; but as these patients have generally been restored, though after a very long confinement, our author thinks it reasonable to suppose that their infirmity had been occasioned by a separation of the bones, which at different periods after the accident, according to the degree of their separation, had recovered their former connection and strength.

Pregnancy.

Chap. II. *Of Pregnancy.*

At the time of conception, and for some time after, the parts which form the small fœtus are so blended together, that one cannot be distinguished from another. The whole mass is then called an *ovum*. This ovum consists of four membranes; the placenta or after-birth; the funis umbilicalis or navel-string, leading to the child; and the surrounding watery fluid in which it floats. Before the child acquires a distinct and regular form, it is called *embryo*, and afterwards retains the name of *fœtus* till its birth. For the increase and nutrition of the fœtus, see Anatomy, n° 109. 110.

During the progress of impregnation the uterus suffers considerable changes; but, though it enlarges as the ovum increases, yet in regard to its contents, it is never full; for, in early gestation, these are confined to the fundus only; and though the capacity of the uterus increases, yet it is not mechanically stretched, for the thickness of its sides do not diminish; there is a proportional increase of the quantity of fluids, and therefore pretty much the same thickness remains as before impregnation.

The gravid uterus is of different sizes in different women; and must vary according to the bulk of the fœtus and involucra. The situation will also vary according to the increase of its contents and the position of the body. For the first two or three months, the cavity of the fundus is triangular, as before impregnation; but as the uterus stretches, it gradually acquires a more rounded form. In general, the uterus never rises directly upwards, but inclines a little obliquely, most commonly to the right side; its position is never, however, so oblique as to prove the sole

cause

Pregnancy. cause either of preventing or retarding delivery; its increase of bulk does not seem to arise merely from distention, but to depend on the same cause as the extention of the skin in a growing child. This is proved from some late instances of extra-uterine fœtuses, where the uterus, though there were no contents, was nearly of the same size, from the additional quantity of nourishment transmitted, as if the ovum had been contained within its cavity.

The internal surface, which is generally pretty smooth, except where the placenta adheres, is lined with a tender efflorescence of the uterus, which, after delivery, appears as if torn, and is thrown off with the cleansings. This is the *membrana decidua* of Dr Hunter.

Though the uterus, from the moment of conception, is gradually distended, by which considerable changes are occasioned, it is very difficult to judge of pregnancy from appearances in the early months. For the first three months the os tincæ feels smooth and even, and its orifice as small as in the virgin state. When any difference can be perceived, about the fourth or fifth month from the descent of the fundus through the pelvis, the tubercle or projecting part of the os tincæ will seem larger, longer, and more expanded; but, after this period, it shortens, particularly at its fore-parts and sides, and its orifice or labia begin to separate, so as to have its conical appearance destroyed. The cervix, which in the early months is nearly shut, now begins to stretch and to be distended to the os tincæ; but during the whole term of utero-gestation, the mouth of the uterus is strongly cemented with a ropy mucus, which lines it and the cervix, and begins to be discharged on the approach of labour. In the last week, when the cervix uteri is completely distended, the uterine orifice begins to form an elliptical tube, instead of a fissure or to assume the appearance of a ring on a large globe; and often at this time, especially in pendulous bellies, disappears entirely, so as to be out of the reach of the finger in touching. Hence the os uteri is not in the direction of the axis of the womb, as has generally been supposed.

About the fourth, or between the fourth and fifth month, the fundus uteri begins to rise above the pubes or brim of the pelvis, and its cervix to be distended nearly one third. In the fifth month the belly swells like a ball, with the skin tense, the fundus about half way between the pubes and navel, and the neck one half distended. After the sixth month the greatest part of the cervix uteri dilates, so as to make almost one cavity with the fundus. In the seventh month the fundus advances as far as the umbilicus. In the eighth it reaches mid-way between the navel and scrobiculus cordis; and in the ninth to the scrobiculus itself, the neck then being entirely distended, which, with the os tincæ, become the weakest part of the uterus. Thus at full time the uterus occupies all the umbilical and hypogastric regions; its shape is almost pyriform, that is, more rounded above than below, and having a stricture on that part which is surrounded by the brim of the pelvis.

The appendages of the uterus suffer very little change during pregnancy, except the ligamenta lata, which diminish in breadth as the uterus enlarges, and at full time are almost entirely obliterated.

The most remarkable change happens in the ovarium. A cicatrice of a roundish figure and yellowish colour appears in this body, called by anatomists the *corpus luteum*. It is always to be found in one of the ovaria; and in cases of twins a corpus luteum often appears in both ovaria. It was formerly considered as the calyx ovi; but modern physiologists think it a gland, from whence the seminal fluid is ejected. In early gestation it is most conspicuous, when a cavity is observable, which afterwards collapses; no vessels appear at the centre of this cavity which has the appearance of cicatrix, but all around that centre the substance is vascular.

During the progress of distension, the substance of the uterus becomes much looser, of a softer texture, and more vascular than before conception; its veins particularly, in their diameters, being enlarged in such a manner as to get the name of *sinuses*; they observe a more direct course than the arteries, which run in a serpentine manner, anastomosing with one another and through its whole substance, especially where the placenta adheres, where this vascular appearance is most conspicuous.

The arteries pass from the uterus through the decidua, and open into the substance of the placenta in a slanting direction. The veins also open into the placenta, and by injecting these veins from the uterus with wax, the whole spungy or cellular part of the placenta will be filled.

The muscular structure of the gravid uterus is extremely difficult to be shown; in the wombs of women who die in labour, or soon after delivery, fibres running in various directions are observable more or less circular, that seem to arise from three distinct origins; viz. from the place where the placenta adheres, and from the aperture or orifice of each of the tubes; but it is almost impossible to demonstrate regular plans of fibres, continued any length without interruption.

Chap. III. *Spurious Gravidity.*

Spurious Gravidity.

The various diseases incident to the uterine system, and other morbid affections of the abdominal viscera, will frequently excite the symptoms and assume the appearance of utero-gestation. Complaints arising from a simple obstruction are sometimes mistaken for those of breeding; when a tumor about the region of the uterus is also formed, and gradually becomes more and more bulky, the symptoms it occasions are so strongly marked, and the resemblance to pregnancy so very striking, that the ignorant patient is often deceived, and even the experienced physician imposed on.

Scirrhous, polypous, or sarcomatous tumors in or about the uterus or pelvis; dropsy or ventosity of the uterus or tubes; steatoma or dropsy of the ovaria, and ventral conception, are the common causes of such fallacious appearances. In many of these cases the menses disappear; nausea, retchings, and other symptoms of breeding, ensue; flatus in the bowels will be mistaken for the motion of the child; and in the advanced

Superfœtation.

vanced ſtages of the diſeaſe, from the preſſure of the ſwelling on the adjacent parts. Tumefaction and hardneſs of the mammæ ſupervene, and ſometimes a viſcid or ſerous fluid diſtils from the nipple; circumſtances that ſtrongly confirm the woman in her opinion, till time or the dreadful conſequences that often enſue at laſt convince her of her fatal miſtake.

Falſe Conception.—Mola. Other kinds of ſpurious gravidity, leſs hazardous in their nature than any of the preceding, may under this head alſo be claſſed; diſeaſes commonly known by the names of *falſe conception* and *mola:* The former of theſe is nothing more than the diſſolution of the fœtus in the early months; the placenta is afterwards retained in the uterus, and from the addition of coagula, or in conſequence of diſeaſe, is excluded in an indurated or enlarged ſtate; when it remained for months or longer, and came off in the form of a fleſhy or ſcirrhous-like maſs, without having any cavity in the centre, it was formerly diſtinguiſhed by the name of *mola.*

Mere coagula of blood, retained in the uterus after delivery, or after immoderate floodings at any period of life, and ſqueezed, by the preſſure of the uterus, into a fibrous or compact form, conſtitute another ſpecies of mola, that more frequently occurs than any of the former. Theſe, though they may aſſume the appearances of gravidity, are generally, however, expelled ſpontaneouſly, and are ſeldom followed with dangerous conſequences.

Chap. IV. *Superfœtation.*

Soon after impregnation takes place, the cervix uteri becomes entirely ſhut up by means of a thick viſcid gluten: the internal cavity is alſo lined by the external membrane of the ovum, which attaches itſelf to the whole internal ſurface of the fundus uteri: the Fallopian tubes alſo become flaccid; and are, as gravidity advances, ſuppoſed to be removed at ſuch a diſtance, that they cannot reach the ovaria to receive or convey another ovum into the uterus. For theſe, and other reaſons, the doctrine of *ſuperfœtation* is now pretty generally exploded.—A doctrine that ſeems to have ariſen from the caſe of a double or triple conception, where, ſome time after their formation in utero, one fœtus has been expelled, and another has remained; or after the extinction of life at an early period, one or more may be ſtill retained, and thrown off in a ſmall and putrid ſtate, after the birth of a full-grown child.

The uterus of brutes is divided into different cells; and their ova do not attach themſelves to the uterus ſo early as in the human ſubject, but are ſuppoſed to receive their nouriſhment for ſome time by abſorption. Hence the os uteri does not cloſe immediately after conception; for a bitch will admit a variety of dogs while ſhe is in ſeaſon, and will bring forth puppies of theſe different ſpecies: thus it is common for a grehound to have, in the ſame litter, one of the grehound kind, a pointer, and a third, or more, different from both: Another circumſtance that has given riſe to *ſuperfœtation* in the human ſubject, which can *only* happen when there is a double ſet of parts, inſtances of which are very rare.

Monſters.

Chap. V. *Extra uterine Fœtuſes, or ventral Conception.*

The impregnated ovum, or rudiments of the fœtus, is not always received from the ovarium by the tuba Fallopiana, to be thence conveyed into the cavity of the uterus; for there are inſtances where the fœtus ſometimes remains in the ovarium, and ſometimes even in the tube; or where it drops out of the ovarium, miſſes the tubes, and falls into the cavity of the abdomen, takes root in the neighbouring parts, and is thereby nouriſhed: But as theſe fœtuſes cannot there receive ſo much nouriſhment as in the ſucculent uterus, they are leſs, and generally come to their full growth before the common term.

Of theſe ſome burſt in the abdomen; and others form abſceſſes, and are thereby diſcharged; others dry, and appear bony, and remain during life, or are diſcharged as above, or by ſtool, &c.

Chap. VI. *Monſters.*

When two or more ova contained in the uterus attach themſelves ſo near one another as to adhere in whole or in part, ſo as to form only one body with membranes and water in common, this body will form a confuſed irregular maſs called *monſtrous;* and thus a monſter may be either defective in its organic parts, or be ſupplied with a ſupernumerary ſet of parts derived from another ovum. This ſeems a rational conjecture; but while every thing relative to generation is a myſtery, how can we account for the extraordinary phænomena? Some authors enumerate a third ſpecies of monſter, the product of a mixed breed, exemplified, for inſtance, in the mule, produced by the mixed generation of an aſs and a mare. In this animal there are organical parts different from what preexiſted in the parents; there is a defect of ſome parts, a luxuriant growth of others; and the defect in the parts of generation, which renders the animal unfit for propagation, conſtitutes a very curious and particular ſpecies.

Chap. VII. *Diſeaſes of Pregnancy.*

After conception, a remarkable change is ſoon produced in the genital ſyſtem. This is the ſource from whence ariſe different ſymptoms, that are however liable to conſiderable variation, not only in the conſtitution of different women, but in the ſame woman in different pregnancies, and at different periods of the ſame pregnancy. Outlines of Midwifery, by Dr Hamilton.

Pregnancy,—though a natural alteration of the animal œconomy, which every female ſeems originally formed to undergo, and hence not to be conſidered as a ſtate of diſeaſe, occaſions, however, ſooner or later, in many women, various complaints, which evidently depend on it as a cauſe.

Diſeaſes incident to the pregnant ſtate may be conſidered, either, 1. As ariſing from ſympathy in the early months; or, 2. As depending on the ſtretching and preſſure of the uterus towards the more advanced ſtages.

I. Though

Diseases of Pregnancy.

I. Though the former of these complaints are generally to be accounted for from other causes than that of plethora; yet, in many constitutions, a certain plethoric disposition in the early months of pregnancy seems to prevail in the vascular system: And therefore, though many inconveniences may ensue from a too frequent, a too copious, or an indiscriminate use of venesection; yet if prudently and judiciously employed, abortion by this means will not be endangered, as some late authors have alledged; but on the contrary, on many occasions, a seasonable bleeding will be attended with the most beneficial and salutary effects.

In young women, suddenly affected with severe sickness and loathing, febrile commotion, headach, vertigo, and other symptoms of breeding, more especially in full sanguineous habits, besides a spare light diet and suitable exercise, recourse must be had to proper evacuations, the chief of which is venesection: this may be safely performed at any time of gravidation, and occasionally repeated according to the urgency of the symptoms; small bleedings, at proper intervals, are preferable to copious evacuations, which in early pregnancy ought always to be carefully guarded against.

When the stomach is loaded with putrid bile or acrid saburra, the offensive matter should be discharged by gentle vomits of ipecacuan, or of infusions of chamomile flowers. The violent efforts to retch and vomit, and the commotions thence excited, which often occasion the expulsion of the fœtus, will by this means frequently be removed, in most cases greatly diminished. During the term of breeding, the state of the belly must be also attended to. When laxative medicines become necessary, those of the mildest and gentlest kind should be administered.

In women liable to nervous complaints, where the stomach is weak, and the sickness violent and continued, the patient should be put on a course of light, aromatic, and strengthening bitters such as infusions of bark, columbo, &c. and her diet, air, exercise, company, and amusement, should be regulated in order to settle the stomach, and lessen the sensibility of the system, opiates will often happily succeed, when every other remedy fails.

Heart burn and *diarrhœa*,—common symptoms of breeding, or of pregnancy, must be treated pretty much as at other times. Both complaints chiefly depend on the state of the stomach.

Tumefaction, tension, and *pains* in the *mammæ*—If tight lacing here be only avoided, and the breasts have room to enlarge and swell, no inconvenience ever follows: These effects arise from a natural cause, and seldom require medical treatment. If very troublesome and uneasy, bathing with oil, or anointing with pomatum, and covering with soft flannel or fur, will in most cases prove the cure.

The *menstrual evacuation*—is in some women regular for the first, second, or third period after conception. This seldom happens but in women of sanguinary plethoric habits, such as have been accustomed to large copious evacuations at other times when the discharge is to be considered as beneficial.

Diliquia, nervous, or *hysteric fits*—When these are occasioned by falls, frights, and passions of the mind, they frequently end in the loss of the child: But when they happen about the term of quickening, they seem to arise from the escape of the uterus from its confinement within the capacity of the pelvis; in which case they are commonly slight, of short duration, and never threaten any dangerous consequence.

II. The second class of complaints, viz. those that are incident to the advanced stages of utero-gestation and that depend on the change of situation of the gravid uterus, its enlargement and pressure on the neighbouring parts are more painful in their symptoms, and more dangerous in their consequences, than those enumerated in the preceding class. The premature exclusion of the fœtus is generally the worst inconvenience resulting from the *one*; the death of the mother, along with the loss of the child, is too frequently an attendant of the *other*.

Difficulty or *suppression* of *urine*—is sometimes occasioned by the pressure of the uterus on the neck of the bladder, before the fundus uteri escapes from its confinement within the brim of the pelvis. This complaint, if early attended to, will seldom prove troublesome or hazardous; but cannot be entirely removed till the uterus rises above the brim of the pelvis, and by its enlargement becomes supported by resting on the expanded bones of the ossa ilia. But if neglected in the beginning,

A retroversion of the uterus—is generally the consequence; a case that demands particular attention.—Here the fundus uteri, instead of being loose, falls back in a reclined state within the hollow of the os sacrum: thus a tumour is formed in the vulva, whereof the os tincæ makes the superior part; the body of the uterus, by this means, becomes strongly wedged between the rectum and bladder; and, from the enlargement of the uterus itself, and accumulating load of fæces and urine, the reduction will prove in many instances utterly impracticable. A total suppression of urine, or a rupture of the coats of the bladder, fever, inflammation, or gangrene of the uterus, often ensue; and these are succeeded by delirium, convulsions, death.

The indications of cure, in this dangerous disease, are sufficiently obvious: For, in the first place, every obstacle that prevents the reduction should be removed: thus the contents of the rectum and bladder must, if possible, be evacuated; emollient fomentations and cataplasms must be applied, if indicated by inflammation or tumefaction of the parts. Secondly, The reduction of the prolapsed uterus must be attempted, by placing the patient upon her knees, with her head low and properly supported. While this is attempted within the vagina, a finger or two should also be passed within the rectum, by which the operation in some cases may be facilitated: but at other times, no power whatever will be sufficient for this purpose. Lastly, If the reduction be accomplished, the fever, inflammatory symptoms, and other consequences of the disease, must be subdued; and a recurrence prevented by an open belly, rest, and recumbent posture, and promoting a free discharge of urine: means that ought to be persisted in till the uterus rises within the abdomen, when the patient will be secured from future danger.

Costiveness

Costiveness in pregnancy--is inconvenient. It may proceed from the same cause with the preceding complaint; it may depend on the stomach; the febrile heat, that in many women prevails, will also prove an occasional cause. It may be obviated or prevented by a proper regulation of the regimen, and by such gentle laxative medicines as are best suited to the state of the woman; the chief of which are ripe fruit, magnesia, laxative electuary, cream of tartar, sulphureous and aloetic medicines, oleum ricini, emollient glysters.

The piles--frequently arise in consequence of costiveness, or from pressure of the gravid uterus on the hæmorrhoidal veins. These are also to be removed or palliated by the same means employed on other occasions; regard being had to this distinction, which may be applied universally to the gravid state, that all violent remedies are to be avoided: a light diet should be enjoined; the belly should be kept moderately open; and topical liniments or cataplasms should be applied, such as Balf. sulphur. Balf. traumaticum, Liniment. ex ol. palmæ, Ung. sambucin. cum laud. liquid. Poultices of bread and milk with opium, &c. according to the various circumstances of the case.

Oedematous swellings of the legs and *labia*,---are occasioned by the languid state of the circulation, by the interruption of the refluent blood from the pressure of the distended uterus on the vena cava, &c. These, though very troublesome and inconvenient, are seldom however of dangerous consequence, except where the habit is otherwise diseased; and seldom require puncture, as the swelling generally subsides very quickly after delivery. They can only, therefore, at this time, admit of palliation; for which purpose, along with a proper diet and moderate exercise, a frequent recumbent posture, open belly, and dry frictions applied to the legs evening and morning, will prove the most effectual means.

Varicous swellings in the legs and thighs---from the interruption of the venal blood in these parts, occasioned by the pressure of the gravid uterus, are to be treated in the same manner with the preceding complaint.

Pains in the back, loins, cholic-pains, cramp,---occasioned by the stretching of the uterus and appendages, and from the pressure of the uterus on the neighbouring parts, symptoms that are most troublesome in a first pregnancy, are to be palliated by venesection, an open belly, and light spare diet. If the patient be of a full habit, and pre-disposed to inflammatory complaints, where the pressure is very great in the advanced months, or in twins, &c. if proper remedies are neglected, inflammation of the uterus and adjacent viscera, or dreadful epileptic fits, may quickly ensue; the event whereof is generally fatal. Crampish spasms in the belly and legs require the same palliative treatment; to which may be added friction, and the application of æther, ol. volatil. balf. anodyn. or the like, to the parts affected.

Cough, dyspnœa, vomitings, difficulty or incontinency of urine, occasioned by the pressure of the bulky uterus on the stomach, liver, diaphragm, &c.---Complaints that can only be alleviated by frequent small bleedings, a light spare diet, and open belly. The patient should be placed in an easy posture, something between sitting and lying; and when the uterus rises high, a moderate degree of pressure from the superior part downwards, may in some cases prove useful. But this must be used with great caution: for dreadful are the effects of violent pressure, or tight lacing, during pregnancy. It frequently kills both mother and child, and ought to be guarded from the earliest months.

Epileptic fits,--are a very dreadful and alarming appearance. They generally depend upon the same cause with the above complaints: they may also arise from irritation, excited by the motion and stirring of the fœtus; and from various other causes. Such as have had convulsions when young, are most liable to have them during pregnancy: they happen most frequently in first pregnancies, or where the fœtus is very large, or in twins, triplets, &c. In such cases, the distention of the uterine fibres is so great, that actual laceration is sometimes the consequence.

At whatever period of pregnancy they seize, the utmost danger may be dreaded. This, however, will be in proportion to the severity, duration, and recurrence of the paroxysm, to the term of gravidation, to the constitution of the patient, and her condition during the remission. The danger is greater towards the latter end of pregnancy than in the earlier months or in time of labour.

Such as arise from inanition, from excessive and profuse hæmorrhagies, from violent blows, falls, &c. or from a ruptured uterus, are for the most part fatal.

Hysteric or nervous spasms must be carefully distinguished from true epileptic fits. The former are milder than the latter; they are not attended with foamings; they do not affect the posture; the pulse is smaller, feebler, and more frequent; the woman is pretty hearty after they are over; they are followed with no bad consequences, and yield to the common treatment. Women of strong, robust, vigorous constitutions, are more generally the subjects of the *one*; the delicate, the nervous, and the irritable, of the *other*.

Epileptic fits generally come on very rapidly; if any previous symptoms occur, the fit is commonly announced by an intense pain in the scrobiculum cordis, or violent head-ach.

In the pregnant state, these fits are for the most part symptomatic, and will therefore only admit of a palliative cure. They may be distinguished into three classes; those of the early months, those of the latter, and those that come on with labour-pains.

With regard to the cure, the term of pregnancy, as well as the constitution of the patient, and particular cause of the disease, must carefully be considered.

1. Convulsions at an early period of pregnancy chiefly happen to young women of a plethoric sanguine habit; and can therefore only be removed or palliated by a free and bold use of the lancet, by an open belly, cold regimen, and spare diet. After plentiful evacuations, if the stomach be loaded with acrid saburra or putrid bile, a gentle puke may be of use: but such remedies, on those occasions, must be employed with great caution. Instead of a plethoric, if the patient is of a nervous habit, a very necessary and important distinction, the intentions of cure will essentially vary. For here opiates in large doses and frequently repeated, emollient glysters, stupes applied to the legs, the semicupium, and every other means to soothe the nerves and remove spasmodic stricture, will prove the most effectual remedies. If insensible

or comatous, opium, musk, and other antispasmodics, should be exhibited by way of glyster, and the patient ought to be roused by epispastic and stimulating cataplasms applied to the legs and hams. Convulsions succeeding profuse evacuations are generally mortal. The vis vitæ, in such circumstances, must be supported, by replenishing the vessels with the utmost speed: this is to be done by pouring in nourishing fluids as fast as possible by the mouth and by glyster; warm applications should also be made to the stomach and feet, and nervous cordials given internally along with opium.

The treatment of epileptic fits, depending on other causes than those now mentioned, must be regulated by a proper attention to the particular symptoms with which they are attended.

2. In the advanced months, such complaints are more to be dreaded than in early gestation, as they generally proceed from the irritation occasioned by the distention of the uterine fibres, or by the pressure of the uterus on the contiguous viscera: hence the natural functions of these parts will be interrupted, the circulation of their fluids will be impeded, and the blood, being thus prevented from descending to the inferior parts, will be derived in greater proportion to the brain, and overcharge that organ.

The cure must, in this case, chiefly rest on copious and repeated bleedings, an open belly, and spare diet.

3. Lastly, when fits come on with labour-pains, a speedy delivery, if it can be done with safety, either by turning the child, or by extracting with the forceps when the head is within reach, will prove the most effectual cure.

When the bladder is distended, the contents must be evacuated: if a stone sticks in the urethra, it must be pushed back or extracted. If the fits are the effects of a ruptured uterus, immediate death is generally the consequence.

With regard to the treatment of such complaints, no other change is generally requisite, than what arises from the symptoms peculiar to this situation. In general, till after delivery, they will only admit of palliation.

Chap. VIII. *Floodings.*

These, though confined to no particular term, may happen at every period of gravidation. The one is a frequent consequence of the other; the event of both is often hazardous, as the earlier miscarriages are generally preceded by an effusion of blood from the uterus, which, in the advanced stages of pregnancy, besides the loss of the child, always endangers the life of the mother.

The *menorrhagia gravidarum*—may be defined, an effussion of blood from the uterus, confined to no regular or stated periods, in quantity and duration various, and liable to recur on the slightest occasions.

The immediate cause is, a separation of some portion of the placenta or chorion from the internal surface of the uterus. Whatever occasions this separation may be considered as the remote cause, which, though various, may be reduced to

I. Those that affect the general system; as,
1. External accidents changing the state of the circulation.
2. Changes in the circulation from internal causes.
3. Debility.
4. Plethora.

II. Those that affect the uterus and placenta: as,
1. Direct affections.
2. Stimuli communicated from an affection of other parts.

With regard to the cure.—Though a flooding in some constitutions may happen, even in early gestation, and may remit and recur from time to time, and the woman go on to the end of her reckoning; and tho' it seldom or never happens that this complaint proves mortal to the mother in the first five weeks of pregnancy; yet every appearance of this kind, even the slightest, is to be dreaded; as in the early months it will often throw off the fœtus, and, in the latter, always threatens the utmost danger both to mother and child. Floodings of gravid women we cannot propose radically to cure; they will only admit of palliation. With this view, the indications are,

I. To lessen the force and velocity of the blood in general.

II. To promote the constriction of the patulous mouths of the bleeding vessels, or the formation of coagula in their orifices.

1. To answer the first indication, rest and a recumbent posture, cool air, tranquillity of mind, a light diet, venesection, and opiates, are the chief means.

2. To restrain the violence of the hemorrhagy, internal astringent medicines are recommended; but this is to be accomplished chiefly by means of cold styptic applications to the parts and their neighbourhood. But as these floodings often arise from so various and opposite causes, it is difficult to lay down particular indications, or to point out a method of cure suited to every case that may occur. The intention of cure can only be regulated by a careful and judicious consideration of the cause, and of those particular circumstances with which the case may be attended. In early pregnancy, it may be restrained by keeping the patient quiet and cool, by giving internally cooling things and opiates; but, in the advanced stages, the deluge is sometimes so profuse as to kill very suddenly. Under such circumstances, when the woman is near her time, emptying the uterus by delivery, if practicable, is the only safe expedient both for preserving the life of the mother and of the child.

If the hemorrhagy can be restrained, a recurrence must be guarded against, by avoiding or counteracting the occasional or remote causes.

Chap. IX. *Abortion, or Miscarriage,*

May be defined, the premature expulsion of the embryo or fœtus. Some, however, make the following distinction: When a woman miscarries in early gestation, this they consider as an abortion; but if in the latter months, that they term a *premature birth.* The symptoms that threaten abortion are:

Flooding.

Pain

Abortion.

Pain in the back and belly.

Bearing down pains with regular intermiſſions.

The evacuation of the waters.

The death of the child, which diſcovers itſelf by the following ſymptoms; though in general theſe are ſo doubtful and fallacious, that none of them afford an infallible ſign:

1. The ſubſiding of the abdominal tumor.
2. Ceſſation of motion in the fœtus.
3. The ſenſation of a heavy weight falling from ſide to ſide, as the woman turns herſelf in bed.
4. Sickneſs, faintings, rigors, cold ſweats.
5. The breaſts turning flaccid.
6. Coldneſs of the abdomen, and putrid diſcharge from the vagina.

Abortions are ſeldom dangerous in the firſt five months; but a frequent habit of miſcarriage debilitates the ſyſtem, ſhatters the conſtitution, and lays the foundation of chronic diſeaſes of the moſt obſtinate and dangerous nature.

In the advanced months, the prognoſis will be more or leſs favourable according to the patient's former ſtate of health, the occaſional cauſe, and ſymptoms with which it is attended. The proximate cauſe of abortion is the ſame with that of true labour, viz. a contracting effort of the uterus and abdominal muſcles, aſſiſted by the other expulſive powers. The remote cauſes cannot be explained with preciſion; as many circumſtances, with regard to the nature of impregnation, and connection of the fœtus with the placenta and uterus, are ſubjects ſtill involved in darkneſs. They may in general, however, be reduced,

I. To whatever interrupts the regular circulation between the uterus and placenta.

II. To every cauſe that excites the ſpaſmodic contraction of the uterus, or other aſſiſting powers.

III. To whatever occaſions the extinction of life in the fœtus.

Amongſt the firſt are:

1. Diſeaſes of the uterus.
2. Impervioufneſs or ſpaſmodic conſtriction of the extremities of the uterine blood veſſels.
3. Partial or total ſeparation of the placenta or chorion from the uterus.
4. Determination to other parts.

To the ſecond general head belong all cauſes that produce a ſtrong contraction of the elaſtic fibres of the uterus, or of the parts that can preſs upon it, or that occaſion a rupture of the membranes: ſuch as,

1. Violent agitation of mind or body.
2. A diſeaſe of the membranes.
3. Too large a quantity of liquor amnii.
4. The croſs poſition of the fœtus.
5. Its motion and kicking.

The laſt head includes the numerous cauſes of the death of the child, which, beſides thoſe referred to in the preceding claſſes, may be occaſioned by,

1. Diſeaſes peculiar to itſelf.
2. Diſeaſes communicated by the parents.
3. External accidents happening to the mother; or,
4. Accidents incident to the fœtus in utero.
5. Diſeaſes of placenta or funis.
6. Knots and circumvolutions of the chord.
7. Too weak an adheſion of placenta or chorion to the uterus: and,
8. Every force that tends to weaken or deſtroy this attachment.

Regimen.

With regard to the treatment. This muſt be varied according to the particular circumſtances of the caſe: nor is it poſſible to point out particular indications, or propoſe any regular plan to be purſued for this purpoſe. Abortion is often preceded by no apparent ſymptom, till the rupture of the membranes, and evacuation of the waters, announce the approaching expulſion of the fœtus. Either to remove threatening ſymptoms, or to prevent miſcarriage when there is reaſon to apprehend it, often baffles our utmoſt ſkill; becauſe it generally happens, that there is a ceſſation of growth in the ovum; or in other words, an extinction of life in the fœtus, ſome time previous to any appearance of abortion. For inſtance, in early geſtation, a woman commonly miſcarries about the 11th or 12th week; but the age of the fœtus at this time is generally no more than eight weeks. At other times, when by accident the fœtus periſhes, perhaps about the fifth or ſixth month, it will ſtill be retained in utero, and the expulſion will not happen till near the completion of full time.

As women who have once abſorbed are ſo liable to a recurrence from a like cauſe, at the ſame particular period, ſuch an accident, in future pregnancies, ſhould therefore be guarded againſt with the utmoſt caution. On the firſt appearance of threatening ſymptoms, the patient ſhould be confined to a horizontal poſture; her diet ſhould be light and cooling; her mind ſhould be kept as tranquil as poſſible; a little blood from the arm may be taken occaſionally; and opiates adminiſtered according to circumſtances: but excepting ſo far as depends on theſe, and ſuch like precautions, for the moſt part, in the way of medicine, very little can be done.

Manual aſſiſtance is ſeldom or never neceſſary during the firſt five months of pregnancy: the excluſion of fœtus and placenta ſhould very generally be truſted to nature.

The medical treatment of abortion muſt therefore be conſidered with a view only to the prophylactic cure: and this again will chiefly conſiſt in a proper

Chap. X. *Regimen during Pregnancy.*

Women, when pregnant, ſhould live a regular temperate life; moderation in eating and drinking ſhould now be very carefully obſerved, and every thing that has any tendency to diſagree with the ſtomach ſhould be avoided; otherwiſe the manner of life ſhould be much as uſual. If complaints do occur, theſe ſhould be treated as at other times; only guarding againſt ſuch things as, by violent operation, may endanger miſcarriage. If the woman has formerly been ſubject to this accident, the cauſe ſhould be carefully conſidered, and ſuitable remedies applied; if plethoric, for inſtance, ſhe ſhould be blooded, live ſparingly, and kept quiet, till ſhe gets beyond the dangerous period. If ſhe be weak, delicate, and nervous, bark, light aromatic bitters, mineral waters, and the cold bath (if able to bear it) will prove the beſt prophylactic remedies. The cold bath has, in many caſes, cured the moſt obſtinate fluor albus, and ſometimes even ſterility itſelf; and, in relaxed habits diſpoſed to miſcarriage, when every other

Regimen. means has failed, the cold bath has done considerable service: the practice may safely be continued for some months after conception, when it has been early begun, or when the patient has been accustomed to it. Such a shock will, however, act very differently on different systems: hence it is an expedient by no means to be indiscriminately used in the pregnant state.

Abortions that happen in early gestation, and that come on suddenly without any presaging sign, if ever they are to be prevented, it can only be done by avoiding all occasional causes, by counteracting morbific dispositions, and by confinement to a horizontal posture, for some time before, and till the critical period be over.

When a venereal taint in the parents is suspected to be the cause either of abortion or the death of the fœtus, the like accident can only be prevented by putting both parties on a mercurial course.

Pregnant women require a free pure air; their amusement should often be varied; their company should be agreeable and cheerful; their exercise should be moderate, and suited to their inclination, constitution, and the season; they should avoid crowds, confinement, travelling over rough roads in a carriage, or being exposed to sea-voyages. Riding a-horseback should also be practised with great caution, that disagreeable objects may be shunned, and shocks of every kind prevented. For this reason, when riding is judged proper, the woman should be a courageous rider; she should never ride without somebody being in company; the horse should be tame and well trained; the road should be smooth as well as private; and the exercise should be gentle and easy, and never carried the length of fatigue. Women should with the utmost care, guard against confining the breasts or belly; early recourse should be had to jumps, and they should keep themselves as loose and easy as possible through the whole term of utero-gestation. An open belly is necessary and important in the pregnant state; it keeps the stomach in good condition, prevents cholics and other complaints that may terminate in miscarriage. When the abdomen is pendulous towards the latter months, a gentle support by proper bandage will prove useful; and the woman, when fatigued, should occasionally, through the day, indulge in rest on a bed or couch. Regimen.

Part II. Of Labours.

Labours are divided into three classes: *natural, laborious*, and *preternatural*.

In whatever manner the head of the child presents, where the delivery at full time is performed by nature, the labour is with great propriety called *natural*; when the birth is protracted beyond the usual time, or cannot be accomplished without extraordinary assistance, it is deemed *laborious*; and *preternatural*, when any other part but the head presents.

Chap I. *Natural Labour.*

By whatever power the uterus is enlarged, when any further increase is prevented, a stimulus to contraction must ensue: by this means an uneasy sensation is excited, which must, in the woman produce an effort to procure relief; and thus arise the true labour-pains, which at first are slight and of short duration, a considerable remission intervening: the periods of recurrence soon become more frequent; the pains acquire an increased force, producing more and more change on the os uteri; which, yielding to the impelling causes, gradually opens and expands; till at length it becomes completely dilated, the membrane protruded and ruptured, and the child, by the expulsive force of the uterus, assisted by that of the diaphragm and abdominal muscles, is thus pushed along and delivered.

The symptoms of approaching labour are, The subsiding of the abdominal tumour: hence a discharge of mucus from the vagina, sometimes tinged with blood; incontinency, or suppression of urine: tenesmus; pains of the belly, loins, and about the region of the pubes; restlessness, hot and cold fits, &c.

Spurious pains are to be carefully distinguished from those of genuine labour. The former arise from the stretching of the uterus and its pressure on the neighbouring parts, or from costiveness; and are to be distinguished from the latter by the following symptoms: They are most troublesome towards the evening, increase in the night, and abate through the day; they are more trifling and irregular than true uterine pains; the uterine orifice is not affected and there is no increased flow of mucus from the parts.

True pains begin about the region of the kidneys, strike forward towards the pubes, and down the thighs: they return at regular periods: there is a copious discharge of mucus from the vagina; the os uteri gradually opens, and can be felt to dilate in time of a pain; while the membraneous bag, in a tense state, forcibly pushes against the finger.

The event of labours is so precarious, that no certain judgment can be formed from almost any symptoms, till the labour itself be considerably advanced. A prognosis in general is chiefly to be formed from the age, state of health, and temperament of the patient; from the force, duration, and recurrence of the pains; and from their effect on the uterine orifice; from the time of the rupture of the membranes; from the general make and form of the woman, but, in particular of that of the pelvis; from the bulk and position of the child, &c.

With regard to the method of delivery, and position of the woman, this has been different at different ages and in different countries: the chief thing, however, is to guard against cold and fatigue, observing that the woman be placed in the most favourable posture for supporting the back, for the action of the abdominal muscles, &c. and most convenient for the necessary assistants: till the labour is considerably advanced, she may be indulged in whatever posture is most agreeable; after which the bed or couch is the most proper.

With regard to assistance in natural parturition, the accoucheur

Natural Labour.

accoucheur for the moſt part has little to do, till the membranes are ruptured, and the head in perinæo. In time of labour, the woman ſhould be kept very cool, and every means of being overheated ſhould be avoided. She ſhould be put to bed in proper time, placed on her ſide or back, with her head and ſhoulders a little raiſed, a cloth tied to the bed-poſt, or held by an aſſiſtant, to ſupport her hands in time of pain, and her feet reſting againſt a foot board; her knees ſhould be drawn up towards the belly, and a folded pillow put between them. All efforts to preſs or ſtrain, except what nature excites, are improper, hurtful, and ſhould be avoided; the membranes, if poſſible, ought not to be ruptured till they almoſt protrude at the os externum; the perinæum muſt be lubricated when formed into a tumor, and carefully ſupported while overſtretched; for this purpoſe, a cloth ſmoothly folded ſhould be applied over the part, to enable the accoucheur to have a firmer hold This is an important part of his office; and muſt be attended to with the ſtricteſt care. From the time this protruſion begins to form till the head of the child be completely delivered, the perinæum muſt be carefully preſerved by the palm of the hand firmly applied againſt it, which ſhould be carried backwards in a direction towards the anus, and kept ſo during every pain. Thus the miſerable conſequences will be prevented to which the neglect of this preſſure expoſes; for by this ſupport the overſtretching of the perinæum will be greatly leſſened, the parts will dilate gently and gradually, the vertex will eaſily ſlip from under the pubes, and the fore-head will riſe from under the perinæum in a ſafe, ſlow, and gentle manner. The perinæum muſt now be releaſed, by cautiouſly ſliding it over the face and chin of the child; and this ought to be made further ſure of by paſſing a finger under it round and round. After the head has thus mechanically advanced through the pelvis and vagina, a pain or two muſt be waited for, when in like manner the body will follow; nothing more being neceſſary than to ſupport the child while it is gradually puſhed forwards by the expulſive force of the natural pains.

When the child has cried, and the change in the circulation freely taken place, the funis umbilicalis muſt be tied and divided, the infant muſt be wrapped in a warm receiver, and given to the nurſe to be waſhed and dreſſed.

The parts of the woman muſt now be gently wiped, a warm ſoft cloth muſt be applied, and a proper time waited for the ſeparation of the placenta.

This is alſo the work of nature, and ſeldom requires more force to bring it along than if it lay entirely looſe within the cavity of the uterus. Thus in pulling, no greater force ſhould be employed than is juſt ſufficient to put the funis on the ſtretch; for if it is already ſeparated, no violence is neceſſary to extract it; and if the adheſion is very firm, all violent efforts are improper, and often followed with moſt dangerous conſequences. Its advancing is known by the contraction of the uterus, and ſhifting of the abdominal tumor, and by the lengthening of the cord. By the ſpontaneous contraction of the uterus, this ſeparation is effected: the expulſion will be ſlower or more expeditious, according to the ſtate and condition of the woman, according to the number of children ſhe has born, and according to the duration or violence of the labour; it is eaſier and ſooner ſeparated in a firſt birth, when the woman is in good health, and when the labour has been properly managed. In moſt caſes, this ſeparation is accompliſhed within half an hour after the delivery of the child. It adheres moſt firmly after premature births, when the woman has been ſickly during pregnancy, where the labour has been tedious and difficult, or when haſty attempts have been made to extract it. A finger, or finger and thumb, guided by the funis, and introduced within the vagina, to bring down the edge, will remove any difficulty occaſioned by the centre or bulky part paſſing the uterine or vaginal orifice.

When it becomes neceſſary to employ force in extracting the placenta, which is never requiſite but in caſes of flooding, when the woman has been in bad health during pregnancy, when ſhe has ſuffered much in time of labour, or when the ſtring has been torn from it (though the firſt of theſe caſes is perhaps the only one wherein the practice is abſolutely proper), the method of doing it is as follows: In ordinary caſes the woman ſhould be laid on her back or ſide; but when the belly is pendulous, or when the placenta is attached to the fundus uteri, ſhe muſt be placed on her knees, which is the moſt convenient poſture.

The accoucheur, though with a certain degree of courage, yet with the utmoſt poſſible tenderneſs, muſt then paſs his hand well lubricated through the vagina into the uterus, and feel for the convex body of the after-birth; if the chord be entire, this will direct him; if not he muſt feel for the looſe membranes at the edge of the cake, and muſt not be deceived by coagula of blood that lie in the way; if the uterus be conſtricted in the middle like a ſand-glaſs, a circumſtance that ſometimes, though rarely, occurs, this muſt be overcome by a gradual dilatation with one finger after another, till the whole hand in a conical manner can ſafely be paſſed. He muſt not content himſelf with feeling a part; he ſhould be able to move his fingers round the whole body of the cake; the adheſion muſt be ſeparated very gradually, in a direction from the ſides round and round. The placenta is diſtinguiſhed from the uterus, as well by its ſoftneſs as by its convex puckered feel. This convexity increaſes in the ſame proportion as the uterus contracts; hence the middle part or centre of the placenta is firſt detached; and if the edges are carefully ſeparated, by gently paſſing the fingers behind, the whole body becomes looſe and diſengaged, which muſt now be brought along with great caution, that no part be left behind, and that no injury be done to the woman in making the extraction.

Though bad conſequences ſometimes follow from the retention of the placenta, yet it is much to be queſtioned, if theſe are not leſs to be dreaded than the dangerous floodings, convulſions, deliquia, inflammation of the uterus, fever, &c. that may be induced from the prepoſterous practice of paſſing the hand to make the extraction: and would it not in general be better to confine the practice of introducing the hand to caſes of uterine hemorrhagies only? Where the adheſion is ſo firm as to require force, or where its place of attachment is out of the reach of the finger, by which, for the moſt part, the edge may be brought down,

Difficult Labour.

down, is it not by far the safest and the most rational practice universally to trust to nature? Should the mouth or body of the uterus become constricted before the separation is effected, no matter; little is to be dreaded: it will afterwards kindly dilate; and the separation and expulsion will spontaneously be accomplished with as much safety as in other animals, where no force is ever used. Let every candid practitioner acknowledge, that for one instance where the retention of the placenta has been attended with dangerous consequences, a precipitate or forcible extraction has proved fatal to hundreds.

After the delivery of child and placenta, the woman must rest a few minutes; her strength and spirits may be recruited by some light nourishing cordial; the wet cloths, &c. must then be removed; the bed must be properly shifted and adjusted; and a gentle compression must be made on the abdomen.

During lying-in, the woman should avoid company and noise; her dress and bed-linens should be often changed; she should avoid every means of being overheated; and with regard to her diet, it should, for the first week at least, be very light and of easy digestion.

Chap. II. *Laborious or difficult Labour.*

Hamilton's Outlines.

When the birth is protracted beyond the ordinary time, or when the child's head though naturally presenting, cannot be brought forwards without assistance, the labour is accounted difficult or laborious.

Though the causes of laborious births are various and complicated, they may in general be considered as depending,

I. On the mother.
II. On the child.
III. On the secundines.

I. The birth may be protracted, or the labour-pains interrupted, by,
  (1.) Debility in the mother, arising,
    a From disease, *viz.*
      1. Flooding.
      2. Epileptic fits.
      3. Crampish spasms.
      4. Lowness and faintishness.
      5. Inflammatory diathesis.
      6. Colic.
      7. Nauseating sickness and vomiting.
      8. Hectic or consumptive habit.
    b From passions of the mind.
    c From mismanagement in time of labour.
  (2.) Local complaints in the parts, or their neighbourhood, *viz.*
    a In the bones occasioning narrowness, and distortion.
    b in the soft parts, *viz.*
      1. Dryness and constriction of the vagina.
      2. Thickness and rigidity of the os tincæ.
      3. Scirrhous or polypous tumours about these parts.
      4. Accumulated fæces in the intestines.
      5. Stone in the urethra.
      6. Prolapsus of the uterus, vagina, and rectum.
      7. Obliquity of the uterus.

II. Difficulties also arise on the part of the child, *viz.*
  1. From the bulk and ossification of the head.
  2. The situation in which the head presents.
  3. Large broad shoulders, or their transverse descent through the pelvis.

III. The secundines, *viz.*
  1. The rigidity of the membranes, and the contrary.
  2. Too great a quantity of water.
  3. The funis umbilicalis too long or too short.
  4. The prolapsus of the funis before the child's head: and,
  5. The attachment of the placenta towards the cervix or os uteri.

The treatment of laborious births requires a very nice and careful attention to the condition of the patient and other circumstances, from whence only we can judge when assistance becomes requisite, and how it may be applied to the best advantage. That pain and misery is the unavoidable and inseparable attendant of child-bearing, though dealt out in different proportions to different subjects, the testimony of all nations, and all ages, as well as daily experience, bear witness; nor is the easiest labour altogether exempted from pain, even under the most favourable circumstances. The delivery, however, promises to be safe and easy, when the woman is of proper age, in good health, the child presenting right, and the pelvis well proportioned; but the force of the natural pains may be interrupted, and of consequence labour be retarded from,

I. Debility in the mother, arising from
  a Disease. This may appear under various forms; as,

1st, A flooding. Which is very alarming, even along with labour-pains: though less so in this case than when at a distance from full time; because as the labour-pains increase, the hemorrhagy very generally abates: or if not, breaking the membranes when the aperture of the os uteri is sufficient to admit the hand, seldom fails to produce that effect. The woman in this case must be kept cool. Opiates must be administered; she must be comforted with the best assurances of a happy delivery: and the natural pains must be waited for.

But if the hemorrhagy proceeds from a separation of the placenta, attached towards the cervix or orificium uteri, in this unhappy case, the whole body of the cake may be completely separated before the aperture of the uterus be sufficient for allowing the head to pass; and the deluge may be so sudden and impetuous that the woman will sink immediately under it. Breaking the membranes and making the delivery, either by turning the child, or extracting with the forceps or crotchet, according to circumstances, with as much expedition as is consistent with the mother's safety, is the only expedient by which the threatning catastrophe may be prevented.

2dly, Epileptic fits may in like manner retard labour and endanger the life of the mother. If the child is not thrown off by a few fits, which is often the case, the delivery should be effected as soon as possible.

3dly,

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3dly, Crampish spasms in the thighs, legs, rarely in the belly, are very troublesome. They depend on the pressure of the head on the nerves as it passes through the pelvis, and can only be removed by delivery; which, as these pains are seldom if ever attended with danger, is not to be forced on this account. Breaking the membranes will sometimes remove them.

4thly, Lowness and faintishness often occur, and frequently prove the cause of protracted labour.

No general rules with regard to the management of slow labour can be recommended. The mode of treatment, where so many circumstances may occur, must be suited to the condition of the patient, as every particular case will in some measure require a different management. Much depends on the prudence and judgment of the attentive practitioner. For instance, when the woman is nervous, low-spirited, or weakly, from whatever cause, in general her strength must be supported; she must not be put on labour too early; she must avoid heat, fatigue, and every means of exhausting her strength or spirits. When she is restless, or the pains trifling and unprofitable, opiates are particularly indicated; they remove spurious or grinding pains, recruit the spirits, procure rest, and amuse time. Little else for the most part is to be done. If the uterus once begins to dilate, though the dilatation goes on slowly, it is by much the best and safest practice to do nothing but regulate the management as above. The pains at last will become strong and forcing; and the delivery, even where the patient has been very weakly, will often have a safe and happy termination. In these tedious labours, if the strength of the woman be properly supported, every thing almost is to be expected from nature. Forcible means should be the last resource.

5thly, Inflammatory diathesis, in young subjects of strong rigid fibres and plethoric habits, must be obviated by venesection, an open belly, and cooling regimen.

6thly, Colic.---Many women have severe attacks of this disease immediately before the labour-pains come on; the reason of which is sufficiently obvious: the belly, which formerly rose so high that the fundus of the womb pressed against the pit of the stomach, afterwards subsiding, by the child's sinking to the lower part of the womb, and the oval of the head being applied to the oval of the basin, the contents of the intestines will be forced lower and lower, and the straight gut will be distended. Hence colic-pains, irritation, and uneasiness, a frequent desire to go to stool, or frequent loose stools, generally ensue. The best palliative remedy is to inject emollient glysters repeatedly till the bowels be entirely emptied. Although some degree of purging should attend the tenesmus, it will be necessary to wash the strait gut, by the use of one or more glysters. The irritating cause being in this way removed, an opiate, if no inflammatory heat or fever prevents, may be afterwards given with advantage.

7thly, Nauseating sickness, with vomiting.---When these symptoms occur, warm water or chamomile tea must be drunk freely. Sickness and vomiting happen in some degree in the easiest labours. Sometimes they proceed from a disordered state of the stomach; but in general are to be accounted for from the well-known sympathy of the womb with the stomach; and accompany the stretching of the os uteri only.

8thly, Hectic or consumptive habit.---It is a melancholy thing to attend a labouring woman in this state. The pains are weak and trifling; she cannot force much down; and she is feeble, and liable to faint when the pain goes off. But however apparently exhausted, the progress of labour goes on, in most cases, much better than could be well expected. The orifice of the womb gives little resistance to the force of the pains, weak and trifling as they are; the parts are soft and lax, and soon stretch in such a manner, that, if there be no fault in the pelvis, the child readily obtains a passage.

Here little is to be done but supplying the patient from time to time with light nourishment; with cordials that do not heat: and keeping up a free circulation of cool air all around her: for this purpose the curtains should be quite drawn aside, doors and windows widely opened; and she should be placed in a position with her head and breast well raised, that an easy respiration may be promoted. Hectic women under proper management rarely sink immediately after delivery; they generally survive a week or longer, tho' they seldom outlive the month.

b. Passions of the mind. Any piece of news in which the patient, her family, or relations are interested, should be carefully concealed, as well as every thing that tends in general to affect the passions; as labour may not only be interrupted from this cause, but the most dangerous symptoms, as floodings, convulsions, deliquia, and fatal syncope, may be induced.

c. From mismanagement in time of labour often arises debility; so that the patient's strength is exhausted, the pains at length entirely cease, and the head of the child remains locked in the pelvis, merely from want of force or pain to push it forwards. In all cases where the labour has the appearance of being tedious, the woman's patience must, as much as possible, be supported. During the grinding pains, she must be kept cool and quiet: opiates may be exhibited to pass the time, till the forcing throes ensue, when she will acquire resolution, the parts will dilate kindly, and the labour end happily; whereas, if she considers herself in labour from the earliest appearance of grinding pains, she is frightened at the length of time, and her patience runs out. Slow lingering labours happen chiefly to elderly women having a rigidity in the parts, to nervous subjects, and to such as have been weakly during pregnancy. It is of great consequence, and the advice cannot be too much inculcated, to avoid exhausting the woman's strength too much at first.

2. *Local complaints in the parts, or their neighbourhood.*

a. Narrowness or distortion of the bones of the pelvis. Where there is any material defect in this cavity, a superficial knowledge of the form and structure of the parts will enable us to judge. If, from the figure of the woman's body, there is reason to suspect a faulty pelvis; if the spine is twisted, the legs crooked, the breast-bone raised, or the chest narrow; whether the pelvis be affected or not, she will require a particular management; for the constitution of such women is weak

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weak and feeble, and they cannot be much confined to bed on account of their breathing. We can never be absolutely certain of a distortion of the pelvis (except when the distortion is confined to the inferior aperture) till the uterine orifice is considerably dilated. After this time, if the pains are strong and forcible, and the head of the child makes no advance, a narrow pelvis or large head is to be suspected. The pelvis may be faulty at the brim, bottom, or in the cavity or capacity. The first of these, which most frequently occurs, is the most difficult to be discovered. The second can be readily perceived by the touch: for we can feel the defects in the shape of the os sacrum and coccyx, in the position of the ischia, and in the bending of the pubes; and where the distortion is so general, that the whole cavity of the pelvis is affected, the shape of the woman's body, the slow progress of the labour, and the state of the parts to the touch, will afford sufficient information.

In the first case, we can only know the distortion by the symptoms; for we should not attempt to introduce the hand till the mouth of the womb be dilated: it is afterwards unnecessary; for we know that the pelvis is too small, or the head too large, by its not advancing in proportion to the pains, and by feeling a sharp ridge like a sow's back on the top of the child's head, which is occasioned by the bones rising over each other in consequence of the pressure.

How long nature, in such circumstances, can support the conflict, it is difficult to say. It is sufficient to observe, that when things are properly prepared for the advance of the child, when the first stage of the labour is accomplished, but its progress is then suspended, it is of little consequence to the midwife whether the obstacle is to be referred to the child or to the mother; and a man-midwife ought to be immediately called in.

If the patient's strength declines; if the head, from being locked in the bones of the pelvis, begins to swell, and the parts of the woman to be affected with tumefaction and inflammation; nature, in this case, seems insufficient, and it will be dangerous longer to delay the proper means of making the delivery; as mother or child, or both, may fall a victim to our neglect. We must not, however, allow ourselves to be imposed on, either by the impatience of the distressed mother, or by the clamours of the officious impertinents about her. In affording that assistance we are able to give, we are only to be directed by the symptoms of the case: we must remember, that the gentlest assistance our hands or instruments in laborious births can afford, is always attended with hazard and risk; that if instruments be applied too early, nature will be thus interrupted in her work, and the most fatal consequences may ensue; and that if assistance be delayed too long, the mother may die undelivered: we ought, however, to be informed, that the former practice of having too early recourse to forcible means, where, in time, nature unassisted might do her business, has proved by far more fatal than the latter. We ought therefore carefully to consider the general history of the patient, and particular circumstances of the case, that we may hit the proper time of making the delivery; which, in these laborious labours, is exceedingly difficult to determine; yet is a matter of the utmost importance, as there is always one, often two or more lives at stake, and the accoucheur is accountable for the consequences of his misconduct or neglect.

b. The fault may be in the soft parts: as,

1. Dryness and constriction of the vagina. Here all stretching and scooping is to be avoided. The natural moisture is to be suppplied by lubricating with pomatum or butter, or by throwing up injections of warm oil; the parts are likewise to be relaxed by the application of warm stupes, or by warm steams directed to them.

2. Thickness and rigidity of the os tincæ. This happens chiefly in women well advanced in life, where the parts open more slowly, and the labour generally proves more tedious. Here also little is to be done but waiting on with patience, comforting the woman as well as possible, and giving an opiate from time to time. The parts may be relaxed with butter or pomatum, by throwing into the vagina injections of warm oil, or by the application of warm stupes to the os externum. Every forcible attempt to open or stretch the uterus, as some authors presume to advise, is apt to induce inflammation and its consequences, and to interrupt the natural pains: it is therefore universally the safest practice to trust in every case to these; though tedious, or even violent, the labour for the most part will end more happily, and the woman recover better, than if force had been employed.

3. Polypous tumors, &c.---There is seldom occasion, in case of cicatrices in the vagina, to dilate with the scalpel, to remove polypous tumors by excision, or to cut upon and extract a stone from the urethra in time of labour. But if circumstances are urgent, such expedients are safe and practicable, and warranted by many precedents.

4. Accumulated fæces in the intestines ought always to be removed by repeated emollient glysters on the first appearance of approaching labour.

5. A stone in the urethra, if it cannot be pushed back, must be cut upon and extracted, as already advised.

6. Prolapsus of the uterus may happen even at full time, in a pelvis too wide in all its dimensions; for which, however, nothing can be done but to support the uterus in time of a pain, that the stretching of the parts may be gradual. Prolapsi of the vagina and rectum must be reduced at the remission of the pain, and a return by gentle pressure must be prevented.

7. Obliquity of the uterus, though a favourite theory of some authors, never happens in such a degree as to influence delivery, except in the case of a pendulous abdomen, or where it depends on the make or distortion of the pelvis. The first of these, though it may, by throwing the child's head over the pubes, occasion perhaps some little delay, will seldom prove any material obstacle to the progress of the labour.

II. The protraction of labour may depend on the child, and may arise from,

1st, the bulk or ossification of the head.

There may be either a natural disproportion between the head and body, or the swelling may be occasioned by a putrid emphysema in consequence of the child's death, or the enlargement may proceed from a hydrocephalus,

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cephalus. The first of these cases can only be discovered by the slow progress of the labour, when the pains are strong and frequent, the soft parts sufficiently dilated, the woman in good health, and no other apparent cause to account for the remora. The second is discovered from the history of the case, from the common symptoms of a dead child, *viz.* the puffy emphysematous feel of the presenting part of the head, and from the separation of the cuticle when touched. Lastly, the hydrocephalus is discovered by the head falling down in the pelvis in a large bulky form, by the bones of the head being separated at considerable distances, and by a fluctuation evident to the touch. On the whole, however, it may here be observed, that the most probable or suspicious symptoms of the child's death are often deceitful.

From whatever cause the head is enlarged, if the difficulty arises from this cause, and the force of the pains prove sufficient to push the head forwards, recourse must be had to instruments; and if the bulk of the head is too large to pass the diameter of the pelvis, the cranium must be opened to diminish its size, and the brain evacuated previous to the extraction.

2dly, The position of the head, which may be squeezed into the pelvis in such a manner as not to admit of that compression necessary for its passing. Such a cause of difficulty, however, more seldom occurs than many authors have imagined. The rash and preposterous application of instruments has, in such cases, proved the bane of thousands. Here though the labour will prove more painful and more tedious, yet nature in general, unassisted, will accomplish her own work with more safety to mother and child, than by the intrusion of officious hands. Turning here is always difficult, often dangerous. The same observation will hold of instruments, which should never be employed but when alarming symptoms occur: the assertion perhaps is not more bold than true, that, in general, the most disadvantageous position in which the head can offer is not sufficient, without some other cause concurring, either to prevent delivery, or to endanger the life of mother or child so much as would be done by the movement of the gentlest hands. Yet, in some cases, where the woman is weak and exhausted, and the pains trifling; if the head of the child be large, the bones firm, and the sutures closely connected; or if there be any degree of narrowness in the pelvis, a difficult labour is to be expected; and the life of both mother and child will depend on a well-timed and skilful application of the surgeon's hands.

The unfavourable position of the head may be referred to two kinds, which include a considerable variety. 1. When the fontanella, or open of the head, presents instead of the vertex. 2. Face-cases.

If no other obstacle appears but the presenting of the fontanella, the labour will by proper management generally end well; and much injury may be done by the intrusion of officious hands.

Face-cases are the most difficult and laborious of all kinds of births; and our success in these will chiefly depend upon a prudent management, by carefully supporting the strength of the woman. The varieties of face-cases are known by the direction of the chin; for the face may present, 1. With the chin to the pubes; 2. To the sacrum; 3. To either side. The rule in all these cases is to allow the labour to go on till the face be protruded as far down as possible. It is often as difficult and hazardous to push back the child, and to bring down the crown or vertex, as to turn the child and deliver it by the feet. Sometimes a skilful artist may succeed in his attempt to alter the position, when he has the management of the delivery from the beginning; or, in those cases where the face is considerably advanced in the pelvis, may be able to give assistance by passing a finger or two into the child's mouth, and pulling down the jaw; which lessens the bulk of the head; or, by pressing on the chin, to bring it under the arch of the pubes; when the crown getting into the hollow of the os sacrum, the head will afterwards pass easily.

3dly, The breadth of the shoulders, or their transverse descent through the pelvis, rarely proves the cause of protracted labour. The head is always pretty far advanced before any obstruction can arise from this cause; and if the head has already passed, in a pain or two the shoulders will follow. The same reasoning will also apply with regard to the aperture of the uterus itself, if the head passes freely, in like manner will the shoulders; the os uteri rarely, if ever, is capable of contracting upon the neck of the child, and thus preventing the advance of the shoulders; and should this prove the case, what can we do but wait with patience? After the delivery of the head, if the woman falls into deliquia, or if, after several pains, the shoulders do not follow, and the child's life be in danger from delay, we should naturally be induced to help it forward in the gentlest manner we are able, by passing a finger on each side as far as the axilla, and thus gradually pulling along.

III. Lastly, From the secundines, difficulty and danger sometimes arise.

1st, The rigidity of the membranes, and the contrary. From the first of these causes, the birth is sometimes rendered tedious; but as the same effect is much oftener produced by the opposite cause, and the consequences of the latter are more troublesome and dangerous than the former, we should always be exceedingly cautious of having recourse to the common expedient of breaking the membranes, which ought never to be done till we be certain the difficulty depends upon this cause; and, even then, the head of the child should be well advanced, and the membranes protruded almost as far as the os externum. Many inconveniences arise from a premature evacuation of the waters; for thus the parts become dry and rigid, a constriction of the os uteri for a time ensues, the pains often either remit or become less strong and forcing, though not less painful and fatiguing; the dilatation goes on so slow, and the labour becomes so severe, that the woman's strength and spirits, by the unprofitable labour, are quite overcome and exhausted; so that the head remains confined in the passage, merely from want of force of pain to push it forwards. The woman in the beginning of labour should therefore be treated with the utmost delicacy and gentleness. The work of nature is too often spoiled by officious hands. She should be seldom touched while the membranes are whole, lest they should be ruptured; and, even when touching is necessary, this should only be done when the

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the pains begin to remit, and the tense membranous bag to relax.

2dly, Too great a quantity of water may prevent the uterus from contracting, and thus weaken the force of the pains. Though this may, however, occasion a delay, it will never be attended with more dangerous consequences; and the same advice already given will hold equally good in this case, that the membranes should never be broken till the soft parts be completely dilated; and we are assured that the difficulty or delay proceeds only from this cause.

3dly, The funis umbilicalis too long. The funis may be faulty from its too great length, or the contrary: thus the extraordinary length, by forming circumvolutions round the child's neck or body, sometimes proves the cause of protracting the labour. But as this can only happen when the chord is of an uncommon length, there is generally enough left to admit of the exit of the child with safety; and it is time enough, in general, after the child is born, to slip the noose over the shoulders or head: there is seldom occasion to divide the chord in the birth; a practice that may be attended with trouble and hazard.

The practice of introducing a finger in ano, to press back the coccyx, or to prevent the head, when it advances, from being re-tracted by circumvolutions of the chord, is now entirely laid aside; an expedient that can answer no end, but that of fretting and bruising the parts of the mother, and injuring those of the child.

Funis too short. The funis is sometimes thick and knotty, or preternaturally thickened by disease. In this case, part of the placenta may be separated as the child advances through the pelvis, and thus a flooding will ensue; or the funis may be actually ruptured, and occasion the death of the child, if the birth does not quickly follow. Such cases, however, rarely happen.

An inconvenience, at least fully as bad as the former, may arise from the too great length of the funis, though it may depend on other circumstances: *viz.*

4thly, The prolapsus of the funis before the head. In this case, the funis, if possible, should be pushed up above the presenting part; for, if the labour pains are slow, and the chord becomes cold, or the pulsation in it begins to grow languid, the circulation will thus be interrupted, and the life of the child destroyed. If the head is far advanced in the pelvis, and the child's life in danger, the delivery may be performed with the forceps. But to push up the head, and turn the child with a view to preserve its life, as many authors recommend, is a practice by no means adviseable: we should seldom, in this position, be enabled to save the child; and turning under such circumstances can never be done but at the immediate hazard of losing the mother.

5thly, Placenta attached towards the cervix or os uteri. This case is truly melancholy; for, if the delivery is not speedily accomplished, the effusion from the uterine vessels will be so copious and profuse, that the unfortunate woman must in a very short time perish. On this occasion the delivery must be conducted in the best manner the judgment and skill of the operator can direct, and with as much expedition as the safety of the mother will admit.

Thus, in most laborious cases, provided the woman's strength be supported, the management properly regulated, the natural moisture of the parts when deficient supplied, manual assistance very seldom becomes requisite; but as cases do occur, wherein nature, with all advantages, will fail, and the common methods of relief prove unsuccessful, recourse must be had to more powerful means, while the woman is able to support the conflict. In all such cases, the condition of the patient, the structure and state of the parts, and position of the presenting part of the child, must very carefully be considered.

Method of Delivery by Instruments.

When the powers of nature are insufficient to expel the child, extraordinary assistance must be had recourse to. In laborious births, this is chiefly of two kinds.

I. The head is either extracted as it presents: or,

II. Its diameter is diminished previous to the extraction.

The head may be detained from advancing through the pelvis by all the causes formerly enumerated.—These are chiefly included in four general ones.

1. Weakness in the mother.
2. Narrowness of the pelvis.
3. The bulk of the head of the child; or,
4. Its disadvantageous position.

Whatever is the cause, when the natural pains begin to remit, and the parts of the woman begin to swell; when her strength declines, her pulse grows feeble, and there is no prospect of advantage to be gained by delay; measures must be taken for assisting the delivery, otherwise both mother and child may perish from neglect.

As instruments are never to be employed but in the most urgent and necessitous cases, and expressly with a view to preserve the life of mother or child, or both; those of a safe and harmless kind should always be made trial of, in preference to those of a destructive nature.

Use of the Forceps.

The forceps is an instrument intended to lay hold of the head of the child in laborious births, and to extract it as it presents. This instrument, as now improved, in the hands of a prudent and cautious operator, may be employed without doing the least injury either to mother or child.

In every obstetrical case, wherein manual assistance becomes necessary, the contents of rectum and bladder should, if possible, be previously emptied.

The membranes also should be broken, the soft parts completely dilated, and the head of the child as far as possible advanced, previous to the use of any instrument.

The form and structure of the parts of the woman, the situation and progress of the presenting part of the child, must at this time be carefully considered. The concavity of the sacrum, for instance, will determine the progress of the labour. The touch of the vertex, fontanella, lambdoidal, or sagittal suture, the fore or back

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back part of the ear, or some part of the face, will ascertain the true presentation of the child.

The lower the head is advanced in the pelvis, our success with the forceps is the more to be depended on. For when it has proceeded as far as the inferior aperture, by means of this instrument it may be readily relieved; but when the head of the child is confined at the brim, both the application of instruments, and the extraction by this means, are exceedingly difficult and dangerous.

The head may be so firmly wedged in the pelvis that the forceps can neither be introduced nor fixed without bruising or tearing the parts of the woman: whatever, therefore, insurmountable difficulties occur, either in applying or extracting with the forceps, the life of the mother must not be endangered by fruitless efforts: the head of the child must immediately be opened, and the delivery accomplished without further delay.

In laborious births, the proper forcep-cases may be reduced to two, which include, however, a considerable variety. These are,

I. The smooth part of the cranium.

II. The face, presenting.

The head may present,

1st, Naturally, when low advanced in the pelvis, with the vertex to the pubes, and the forehead or face in the hollow of the sacrum. Or,

2dly, When higher in the pelvis, the vertex may present with the face laterally, the ears to the pubes and sacrum. Or,

3dly, The fontanel may present with the face to the pubes and vertex to the sacrum; or with the vertex to the pubes and face to the sacrum.

1. When the head presents naturally. The woman in this case must be placed on her back a-cross the bed, properly supported; the accoucheur, seated before or in a kneeling posture, after gradually lubricating the perinæum and vagina, must proceed gently to stretch the parts, by passing the hand in a conical manner through the os externum vaginæ, pushing it forwards by the side of the child's head, till it advances as far as an ear, if possible: along this hand he is to guide a blade of the forceps, which with the other hand he introduces in the direction of the line of the pelvis, holding the handle backwards towards the perinæum, and keeping the clam closely applied to the child's head. This must be insinuated very gradually by a kind of wriggling motion, pushing it on till the blade is applied along the side of the head over the ear; he must then gently withdraw the first hand from the pelvis, with which he must secure the handle of the blade of the forceps already introduced, till the other blade be passed along the other hand, in the same slow cautious manner: the handles must then be brought opposite to each other, carefully locked, and lest they slip in extracting, properly secured by tying a fillet or garter round them; but this must be loosed during the remission of pulling, to prevent the brain from being injured by the pressure. The extraction must be made by very slow and gentle degrees, and with one hand only, while the other is employed to guard the perinæum: the motion in pulling should be from blade to blade; the accoucheur must rest from time to time, and, if the pains are not gone, should always in his efforts only co-operate with those of nature. The child and mother will suffer less by going on in this gradual manner than by precipitating the birth, which can never be done but at the risk of destroying both. If, in making the extraction, the forceps slip, they must be cautiously withdrawn blade by blade, and again introduced in the same manner.—When the tumour of the perinæum forms, and the vertex begins to protrude at the os externum, the accoucheur must arise from his seat, raise the handle gently upwards, and by a half round turn, bring the hind-head from under the symphysis or arch of the pubes; remembering carefully to guard the perinæum from laceration and its consequences, to which it is now so greatly exposed.

In attempting the introduction of either blade, if it meets with any interruption, it must be as often withdrawn, and pushed up again in a proper direction till every difficulty be surmounted; and if, from the smallness or constriction of the parts, the introduction of the second blade shall seem impracticable, the former one must be withdrawn, and the latter must be first introduced.

2. The vertex may present with the face laterally in the pelvis. It is always difficult to apply the forceps till the bulky part of the head has passed the brim; and here it is not only difficult to the operator, but extremely hazardous to the patient, to introduce this instrument till the ear of the child has got under the pubes. When the ears thus present to pubes and sacrum, the woman should be placed on her side or knees, the most difficult blade of the forceps should be first applied, which is the one under the pubes; when both are passed, and properly secured, the patient should again be turned to her back, before the operator attempts to extract, and the head in this case (as the quarter-turn can seldom be made with safety) should be delivered in the manner wherein it presents; because, when confined any time in the passage, its figure is altered by the overlapping of the bones, in such a manner that it passes along, in general, with far less difficulty than to attempt to push up and make the mechanical turns; a work often altogether impracticable, by which contusion or laceration of the parts of the woman, and the most fatal consequences, may be occasioned. The handles of the forceps must here particularly be well pressed backwards towards the perinæum, that the clams may humour the curvature and intrusion of the sacrum, and accommodate themselves to the form of the child's head.

This is a case wherein the forceps often fail; if so they will sometimes succeed by varying the mode of application, and fixing them over the forehead and occiput; if this method fails also, the size of the head must be diminished, and the extraction made with the blunt hook or crotchet.

3. The fontanella may present with the face to the pubes. This is the most common of the fontanel cases; though sometimes the face is lateral in the pelvis, sometimes diagonal, and sometimes it is turned to the sacrum. The true position is ascertained by the direction of the fontanel, and that of the ear. Here, as in other laborious births, nature should be intrusted as long as we dare. The hand does not always de-

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ſcend mechanically through the capacity of the pelvis, as ſome practitioners have ſuppoſed; nor will the deviation from its ordinary mode of deſcent always of itſelf influence the delivery, at leaſt very rarely in ſuch a manner as to require extraordinary aſſiſtance. In whatever manner the head preſents, when it is ſituated high in the pelvis, the delivery cannot be effected without difficulty or hazard; in ſuch circumſtances, the application of the forceps will frequently baffle the utmoſt efforts of the accoucheur, and the conſequences of ſuch attempts may prove fatal to mother and child.

When extreme weakneſs in the mother, floodings, convulſions, or other urgent ſymptoms, render it neceſſary to force the delivery, whether the face be to pubes or ſacrum, the forceps may be applied along the ears, in the ſame manner as directed in a natural labour; and the head, for the reaſons already given, ſhould be brought along in the manner it preſents: the extraction ſhould be made with great deliberation, that the parts of the woman may have time to ſtretch; the perinæum muſt be carefully ſupported; the forceps muſt be gently releaſed, when the head is delivered; and the reſt of the delivery conducted as in a natural labour.

In this caſe, when ſituated high in the pelvis, the fontanel preſenting, and the face either to pubes or ſacrum, the long axis of the head interſects the ſhort diameter of the pelvis, and very often, though the forceps be applied, and a firm hold of the head be obtained, it is not poſſible to bring it along with all the force we dare exert. If this method therefore fails, the common forceps ſhould be cautiouſly withdrawn, and the long ones applied if poſſible, over the forehead and occiput, when the ſize of the head, by the compreſſion it ſuffers in paſſing along, being perhaps ſomewhat diminiſhed, the extraction will be ſucceſsfully performed. This method alſo failing, previous to the operation of embryotomy, Dr Leak's forceps, with the third blade, may be had recourſe to. But of this little can be ſaid with confidence, till the inſtrument has been more generally employed. From the difficulty of ſucceeding in the application of the common forceps, it may, *à priori*, be concluded, that the introduction of a third blade, even in the hands of an expert practitioner, however ingenious the invention, is an expedient not eaſily to be put in practice. Neither is Roonhuyſe's lever, or a blade of the forceps paſſed up between the pubes and fore-head or hind-head of the child, in order to procure the delivery of the head, to be recommended in ſuch caſes: however ſome have boaſted of its ſucceſs, it is an inſtrument that may do much miſchief; and few practitioners can uſe it with ſafety.

II. *Face preſenting.*—Of laborious births, face-caſes as we have already obſerved, are the moſt difficult and the moſt dangerous. From its length, roughneſs, and inequality, the face muſt occaſion greater pain; and from the ſolidity of the bones, it muſt yield to the propelling force with much more difficulty, than the ſmooth moveable body of the cranium. Face-caſes are the moſt troubleſome that occur in the practice of midwifery, and in which the moſt expert practitioners may be foiled in their attempts; and theſe attempts, if too early exerted, will be followed in many inſtances with fatal conſequences. Whatever way the face preſents, it ſhould be allowed to advance as low as poſſible in the pelvis; by which means the acceſs will be more eaſy, and the poſition, for the application of inſtruments, more favourable. In this aukward ſituation, much miſchief may be done by raſhneſs; whereas, if time be allowed, and the patient be properly ſupported, the delivery will generally end well.

The face may preſent with,

1. The chin to the pubes.
2. to the ſacrum.
3. laterally.

From the difficulty of applying inſtruments in theſe caſes, ſome authors recommend, as an univerſal practice, to turn the child, and deliver by the feet. But this in general is a dangerous practice, and ſeldom or never adviſeable, except when the membranes remain entire, till the os uteri is completely dilated, and the head continues looſe about the brim of the pelvis; and even then the propriety of the practice is doubtful; becauſe if the head is ſmall, or the pelvis be well proportioned, the face will deſcend without much difficulty; and if otherwiſe, beſides the riſk in attempting to turn, the child may be loſt from the preſſure of the chord, or the difficulty of extracting the head after the delivery of the body.

When aſſiſtance becomes neceſſary, the beſt practice in face-caſes is the following: Having placed the patient in a convenient poſture, let the accoucheur in the gentleſt manner paſs his hand within the pelvis; and during the remiſſion of pain only, endeavour to raiſe the head of the child, ſo that he may puſh up the ſhoulders entirely above the brim of the pelvis, and thus change the poſition of the face: by this means, if ſucceſsful, he will be able to reduce the firſt of theſe caſes, ſo as to make the fontanel preſent with the face to the pubes; he will reduce the ſecond ſo as to bring down the vertex, with the face to the ſacrum; and the third he will reduce to a vertex caſe, with the face lateral. The delivery may be afterwards truſted to nature; which failing, there is eaſier acceſs for the application of inſtruments to make the extraction, as already directed. The ſucceſs, however, of the accoucheur, in altering the poſition of the head, by puſhing it up, will entirely depend on the time he is called; for, ſhould the head be firmly wedged in the pelvis, no force he dares employ will be ſufficient to alter the poſture

If therefore every attempt to reduce the face, and make the vertex or fontanel preſent, ſhall prove unſucceſsful, and ſymptoms are urgent, the forceps muſt be applied over the ears of the child, and the extraction performed in the beſt manner the operator is able. And, failing theſe, immediate recourſe muſt be had to the crotchet.

1. In the firſt caſe, previous to the introduction of the forceps, the chin if poſſible ſhould be advanced below the pubes.

2. In the ſecond, the chin ſhould be advanced to the inferior part of the ſacrum. And,

3. In the third, the chin ſhould be as low as the hinder part of the tuber iſchii: and although in general the head is to be extracted as it preſents, if the operator meets with conſiderable reſiſtance, it muſt be gently puſhed up and turned with the chin, either laterally,

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terally, below the pubes, or into the hollow of the sacrum, according to the particular circumstances of the case, and in a direction best accommodated to the form and diameter of the pelvis.

Use of the Scissars, Crotchet, and Blunt Hook.

When the head of the child, from its size, unfavourable position, or from a fault in the pelvis, cannot be protruded by the force of natural pains, nor extracted by the forceps, recourse must be had to more violent means, and the life of the child must be destroyed in order to preserve that of the mother. This operation was by the ancients called *embryotomy*.

When the head, from its extraordinary bulk, is detained at the brim of the pelvis; on evacuating the contents, the bones of the cranium immediately collapse, and the head is afterwards propelled by the force of the labour-pains; failing which only, the extraction must be made with the blunt-hook or crotchet.

The unfavourable position of the head is of itself a cause insufficient to justify the use of destructive instruments, which ought never to be employed but in extreme cases, after every milder method has failed. From the difficult access to the cranium in order to make a perforation and evacuate the brain, a face-case makes a very troublesome and dangerous crotchet one. Very luckily, in narrow pelvises, the face rarely presents, and very seldom advances far in that direction; at other times, the position may be so altered, that the crown, the back of the ear, or some other part of the cranium, can be reached; otherwise the crotchet must be fixed in the mouth, orbit of the eye, &c. and the head brought along in that direction, till the scissars can be employed to open the skull.

But the grand cause of difficult labour is, the narrowness or distortion of the pelvis. For when, at the brim, instead of four inches and a quarter from pubes to sacrum, it measures no more than one and a half, one and three-fourths, two, or two inches and one-fourth, the use of instruments becomes absolutely requisite, and very frequently in those of two inches and one-half, and three inches; or when the diameters through the capacity, or at the inferior aperture, are retrenched in the same proportion, difficulties will in like manner arise, and the delivery, except the labour be premature, or the child of a small size, cannot be accomplished without the assistance of destructive instruments.

We judge of the form of the woman; by the progress of the labour; by the touch. When the fault is at the inferior aperture, the touch is pretty decisive; *e. g.* if a bump is felt in the os sacrum instead of a concavity; if the coccyx is angulated; if the symphysis pubis projects inwards in form of an acute angle; if the tuberosities of the ischia approach too near each other; or the one tuber be higher than the other; such appearances are infallible marks of a distorted pelvis. But when the narrowness is confined to the brim, this is only to be discovered by the introduction of the hand within the pelvis: the projection of the lumbar vertebræ over the sacrum, is a species of narrow pelvis that most frequently occurs in practice. In this case, the child's head, by the pressure it sustains between the pubes and sacrum, is moulded into a conical or sugar-loaf form, the parietal bones are squeezed together, over-lapping one another, and will be felt to the touch when the labour is advanced, like an acute ridge, something in the form of a sow's back.

Instead of the complicated instrumental apparatus invented by the ancients, such as screws, hooks, &c. for fixing in, laying hold of, and extracting the head as it presented, an operation in many cases difficult and dangerous, when the head was bulky or the pelvis narrow, as the woman frequently lost her life in the attempt; the practice of diminishing the size of the head, by opening the cranium and evacuating the brain, previous to the extraction, is a modern improvement, and an important one: the instruments for this purpose consist simply of a pair of long scissars, a sharp curved crotchet, and a blunt hook: these are preferable to every other, whether of an ancient or modern construction.

When the accoucheur is under the disagreeable necessity of destroying the child to preserve the mother, she must be laid in the same position as already advised for the application of the forceps; and the same rules, recommended for the one operation, will in general apply to the other.

Thus, in the narrowest pelvis that occurs, previous to opening the cranium, the soft parts should be completely dilated, and the head of the child should be fixed steadily in the pelvis and advanced as far as possible; for while the head is high and loose above the brim, the application of instruments is very difficult as well as hazardous.

The long scissars must be cautiously introduced into the vagina, directed by the hand of the accoucheur; the points must be carefully guarded, till they press against the cranium of the child, which they must be made to perforate with a boring kind of motion, till they are pushed on as far as the rests; they must then be opened fully, carefully re-shut, half turned, and again widely opened, so as to make a crucial hole in the skull. They must afterwards be pushed beyond the rests, opened diagonally again and again, in such a manner as to tear and break to pieces the bones of the cranium; they must then be shut with great care; and withdrawn along the hand, in the same cautious manner as they were introduced, lest they should bruise or tear the uterus, vagina, or any other part of the woman. After a free opening in the cranium has thus been made, the brain must be scooped out with the fingers or blunt-hook, and the loose sharp pieces of bone must be carefully separated and removed, that no part of the woman be tore while the head is extracting. The teguments of the scalp should now be brought over the ragged bones of the cranium, and the woman should be allowed to rest an hour or two, according to her strength and other circumstances: the bones of the cranium will now collapse; and if the woman has as much strength remaining, or the pelvis be not much distorted, the head being thus diminished, will be protruded by the force of natural pains; otherwise it must be extracted, either by means of two fingers introduced within the cavity of the cranium, by the blunt-hook introduced in the same manner, guarding the point on the opposite side while making the extraction; or, failing these, by the crotchet, which, though dan-

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dangerous in the hands of an ignorant rash operator, may be employed by the prudent practitioner with as much safety as the bluntest instrument.

The method of introduction is the same with a blade of the forceps. The chief thing to be attended to is, to guard the point till it be applied against the head, and firmly fixed in its hold, which should always be somewhere on the outside of the cranium: provided a firm hold is obtained, no matter where, behind the ears, about the os petrosum, orbits of the eyes, maxilla inferior, &c. according to the presentation of the head. The woman being properly secured, and the handle of the instrument covered with a cloth, the operator must then pull, at first gently, afterwards more forcibly, resting from time to time, and endeavouring to make the extraction in the best manner the circumstances of the case will admit of. If the pelvis be much distorted, so that, by means of the utmost strength the accoucheur can exert, little purchase is made, he may apply to the opposite side a blade of the forceps, which are now so constructed as to lock with the crotchet; let him then bring the handles together, secure properly, and thus endeavour to make the extraction. Should this expedient also fail, the blade of the forceps must be withdrawn, the other blade of the crotchet must be applied, the handles brought together and secured, and the extraction made, moving from blade to blade.

Should the head present in such a manner, that, in attempting to extract it, the crotchet divides the vertebræ of the neck, and the head is thus severed from the body, an accident that can only happen in the hands of an ignorant blundering practitioner; the head must be pushed up above the brim of the pelvis, the crotchet or blunt hook must be fixed under the axilla, the arms must be brought down, and the body extracted, by fixing the crotchet below the scapula on the sternum, or among the ribs; the head must afterwards be extracted in the manner already advised: or should the head in extracting be pulled from the body, as may happen when the child has been long dead, or when it is putrid, the delivery of the body must be effected by means of the crotchet as now directed; a method preferable to that of turning, as some advise.

If the head, instead of yielding to the force of pulling, be at last cut and broken in pieces, the operator must endeavour to bring down an arm of the child, to fix the crotchet about the jaw or neck, pull at both holds, and thus attempt to make the extraction; this also failing, he must bring down the other arm, fix the crotchet in the thorax, and, in a word, must tear the child in pieces, that the delivery may be accomplished by any means.

In face-cases, where it is impracticable to alter the position, and when the pelvis is much distorted, the double crotchet is sometimes requisite; the handles must be well secured, kept well backwards towards the perinæum, and the motion always from blade to blade. It very seldom, however, happens, that there is occasion for the double crotchet: by this means the head is flattened in pulling; whereas if one blade only can be employed, the head is lengthened, and, in pulling, can better accommodate itself to the shape of the pelvis as it passes along.

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Chap. III. *Preternatural Labour.*

In whatever manner the child presents when the body is delivered before the head, the birth is accounted preternatural.

Preternatural labours may be referred to one of the four following classes.

I. When one or both feet, knees, or the breech, present.

II. When the child lies across in a rounded or oval form, with the arm, shoulder, side, back, or belly, presenting.

III. When one or both of the upper extremities present, the child lying in the form of a sheath, the feet towards the fundus uteri, the waters evacuated, and the uterus strongly contracted round the body of the child.

IV. Lastly, Premature or flooding cases, or others in which it may be necessary to force the delivery, either previous to the rupture of the membranes, or quickly after it.

The causes of cross labours most commonly assigned by authors are, The obliquity of the uterus: circumvolutions of the funis umbilicalis round the child's body; the shortness of the funis, or attachment of the placenta towards the fundus uteri; shocks affecting the mother when pregnant, &c. The position of the fœtus may also be influenced by its own motion and stirrings, by the particular form and bulk of its body, by the manner of stretching of the uterus, by the quantity of liquor amnii, and by many other circumstances.

The symptoms that indicate an unfavourable position of the child, before it can be discovered by the touch, are very uncertain and fallacious; a cross birth may however, be suspected,

1st, If the pains be more slack and trifling than ordinary.

2dly, If the membranes be protruded in a long form like a gut, or the finger of a glove.

3dly, If no part of the child can be discovered when the uterine orifice is considerably opened.

4thly, If the presenting part through the membranes be smaller, feels lighter, and gives less resistance than the bulky ponderous head.

5thly, Lastly, after the rupture of the membranes, if the meconium of the child be passed along with the waters, it is a sign that the breech presents, or that the child is dead.

Preternatural labours are difficult or hazardous, according to,

1. The form of the pelvis, and general health and constitution of the woman.

2. The bulk of the child, and its manner of presenting.

3. The time the waters have been evacuated, and the uterus contracted round the body of the child.

4. When complicated with plurality of children; the prolapsis of the funis umbilicalis; the limbs of the child entangled with the chord; profuse and violent flood-

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floodings from the attachment of the placenta towards the cervix uteri, &c.

Turning is often laborious, and always dangerous in proportion to the force used in searching for and bringing down the feet; though in general, the difficulty and hazard are not so great, as in many cases strictly called *laborious*, when the head presents; the treatment of preternatural labours being better known, and for the most part easier put in practice.

Each class of the general division of cross labours includes a variety of different cases. By considering a few of every class, a general idea of the whole will be formed.

CLASS I.

Case 1. The simplest and easiest case is the Agrippan posture, when the child presents with the feet.

The foot is to be distinguished from the hand, first, by the weight and resistance it gives to the touch; secondly by the shortness of the toes; thirdly, by the projecting heel.

When the feet present in the passage, the labour should be allowed to go on as if natural. If the child be of an ordinary size, the woman in health, the parts well proportioned, in the way of assistance nothing further seems necessary but the application of a warm cloth round the body of the child, which must be properly supported till it advances as far as the pains are able to force it. If the size be ordinary, or rather small, it will sometimes make the mechanical turns and be entirely pushed along by the force of the natural pains; but it generally stops at the shoulders, after the breech protrudes without the os externum, where the resistance is so great, that the accoucheur's assistance becomes requisite.

In this case, the patient must be placed on her back, properly supported; the hand of the accoucheur must be cautiously introduced; the parts of the woman must be gently stretched; the feet of the child must be laid hold of, and brought as low in the vagina as possible; a soft warm cloth must be wrapped around them, and the extraction must be performed in a slow cautious manner, making large motions in a circular or lateral direction, resting from time to time, if the pains are gone; and if not, always waiting for the natural efforts. When advanced as far as the breech, the body, if not already in a proper direction, must be pushed up, and gently turned with the face towards the mother's back; and to make sure that the face turns with the body, or to prevent the chin, vortex, or shoulders, from catching on the pubes, or angle of the sacrum, an extraordinary quarter-turn more must be made: this must be reversed previous to the extraction; and the difficulty arising from the obstruction of the shoulders must be removed in the following manner: While the breast and legs of the child are supported over the palm and fore arm of the one hand of the accoucheur, which he draws towards one side, he must introduce two fingers of the other hand at the opposite side into the vagina, over the back-part of the shoulder, as far as the elbow, and endeavour in the most gentle manner to bring down the arm, always remembering in his movements to humour the natural motions of the joint: he must then shift hands, when the other arm is to be relieved in the same manner: both arms being brought down, the woman must now rest a little, when a pain or two generally follows, and the head is also forced along. But should the woman be much exhausted, and if the head does not quickly advance, the child may be lost from delay. The extraction of the head in preternatural labours is often the most difficult and the most dangerous part of the delivery; the cause of resistance, when it does not advance, is chiefly owing to its confinement between the angle of the sacrum and pubes, when the bulky part of the head is detained at the brim; whether the resistance be here or towards the inferior aperture of the pelvis, if the head does not advance in a pain or two, the extraction must be made in this manner: While the right hand of the accoucheur supports the body of the child below, with two fingers pressing on either shoulder, the left hand and fingers must in the same manner be placed over the back of the neck, and pulling gently in the direction from pubes to sacrum, he must thus endeavour to bring it along; but, should the pelvis be narrow, or the child's head of a large size, or the face be laterally or anteriorly placed in the pelvis, or, what rarely happens, the os uteri contracted round the neck of the child; in either of these cases, the accoucheur will sometimes meet with the utmost difficulty. When the above method therefore fails, he must introduce two fingers of the right hand into the child's mouth, while those of the left-hand are expanded over the shoulders, as already directed; and in this way he must endeavour to relieve it, pulling from pubes to sacrum, alternately raising and depressing the head till it advances low down, so that the face descends from the hollow of the sacrum, when the accoucheur must rise from his seat, and bring the hind-head from the pubes with a half round turn, imitating that of a natural labour.

If the position be unfavourable, the face, if possible should be turned to the sacrum, by pushing up the head, or by pushing back the chin; If the contraction of the uterus is the cause of resistance, which rarely occurs, it must be gently stretched with the fingers. Or if the difficulty arises from circumvolution of the chord round the legs, thighs, body, or neck of the child, these must be disengaged in the easiest manner possible; it is rarely necessary to divide the funis on this account.

Should every method fail in bringing down the head, the delivery must be effected by means of the forceps cautiously passed over the ears, with the handles under the child's body, in a direction downwards towards the perinæum. If the pelvis be very narrow, or the head of a large size, it must be opened by pushing the scissars through the occipital bone, so that the contents of the cranium may be evacuated, and the extraction made by means of the forceps, blunt hook or crotchet. But if the head, by the efforts to extract it, be actually severed from the body, and left behind in the uterus, an accident which sometimes occurs, it must be delivered by inclosing it in the forceps, while secured from rolling by pressing externally on the abdomen. If the forceps cannot be applied, the cranium must be opened, the texture of the brain destroyed, and the extraction performed by the fingers of the accoucheur, by the blunt-hook, or by the crotchet. If the under-jaw remains, the head

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head may be effectually secured till locked in the forceps, or till its bulk be diminished, by introducing a finger into the mouth, thrusting it through the jaw under the chin, drawing it down, and passing a ligature through the perforation.

In cases where the child has been long dead, should the belly or thorax be distended with air or water, and prove the cause of obstruction, the contents must be evacuated by opening with the scissars or tearing with the crotchet; and in general, where difficulties occur, the delivery must be accomplished in that manner the circumstances of the case will best admit of.

Case 2. When instead of two, one foot only falls into the vagina, the other is sometimes detained by catching on the pubes, and if easily come at, should be brought down, always remembering to humour the natural motion of the joint; but, should the leg be folded up along the child's body, the attempt is sometimes both difficult and dangerous, and ought not to be persisted in, as the breech will either be forced down by the assistance of natural pains, or by gently pulling by one leg only.

Case 3. When one or both knees present, the delivery must be conducted in the same manner with that of the feet.

Case 4. When the feet offer along with the breech, this last must be pushed up, while the former are secured and brought down till it be reduced to a footling case, and otherwise managed as above.

Case 5. The breech may present with the fore-parts to the mother,

1st, Anteriorly;
2dly, Laterally; or,
3dly, Posteriorly.

Sometimes the breech may be discovered, previous to the rupture of the membranes; but afterwards with more certainty, by the meconium of the child passed with the waters, and by the touch.

In whatever manner the breech presents, the delivery should be submitted to nature, till the child be advanced as far as the thorax, when the feet are to be brought down and laid hold of, the child, if necessary pushed up, the mechanical turns effected; and the delivery otherwise conducted as in a footling case. There is much less hazard in general, agreeable to an old observation of Mauriceau, in allowing the child to advance double, than in precipitating the extraction by pushing up to bring down the feet before the parts have been sufficiently dilated; a practice difficult and troublesome to the operator; painful, and sometimes dangerous, to the mother; and by which the child is exposed to the risk of strangulation, from the retention of the head after the delivery of the body. If the child be small, though doubled, it will easily pass in that direction; if large though the labour be painful, the natural throes are less violent and less dangerous than the preposterous help of the accoucheur: If the child thus advances naturally, it will be less exposed to suffer; if it does not advance, the parts of the mother will be prepared for the accoucheur to pass his hand into the pelvis, to raise up the breech, to bring down one or both feet, and deliver as above.

Weakness in the mother, floodings and convulsions, a very large child, or narrow pelvis, the prolapsus of the funis, or its compression between the thighs of the child, or between the child and pelvis, by which its life is endangered, if the chord cannot be reduced above the presenting part, are the only exceptions to the general rule of treating the breech as a natural labour.

The practice of helping forward the breech, by passing the blunt-hook under the ham, is now entirely laid aside; this can never be done with safety, till the breech be so low advanced, that the hand of the accoucheur can be used, which may be employed with more advantage as well as safety.

CLASS II.

In the former class of preternatural labours, it is adviseable to trust to nature in many cases, as the birth will often be accomplished without manual assistance: but when the child lies a-cross, no force of pain can make it advance in that position; and, without proper assistance, both the mother and child would perish.

If the accoucheur has the management of the labour from the beginning, the child may be turned, in the worst position, without difficulty; but when the waters have been for some time evacuated and the uterus strongly contracted, turning is laborious to the operator, painful and dangerous to the mother. In such cases, the ancients endeavoured to make the head present; but from its bulk, they often failed, and the attempt was often attended with fatal consequences. The method of delivering by the feet is the most important modern improvement in the practice of midwifery; an improvement to which many thousands owe their lives.

When the child lies in a transverse position, the accoucheur must insinuate his hand through the vagina into the uterus in the gentlest manner, search for the feet, bring them down with the utmost caution, and finish the delivery as in footling-cases. To effect this the following rules should be observed.

1. The patient must be placed in a convenient posture, that the operator may be able to employ either hand, as the various circumstances of the case may require.

2. Though the best posture, in general, is laying the woman on her back, it will be sometimes necessary to turn her to her side; and, in these cases, where the abdomen is pendulous, where it is difficult to reach the feet, or where they lie towards the fundus uteri, the woman should be placed on her knees and elbows.

3. An exact knowledge of the true position of the child, and of the structure and state of the parts, should be acquired, before attempting to make the delivery.

4. The orifice of the uterus should be enlarged, so as freely to admit the hand; and the stronger pains should be abated, before any attempt be made to deliver.

5. Should the waters be drained off, the parts dry and rigid, and the uterus contracted round the child, warm oil must be injected into the uterus, otherwise its rupture may be endangered.

6. In passing the hand into the uterus, this must be done

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done in the gentleſt manner; the parts muſt be well lubricated with butter or pomatum; the line of the pelvis muſt be attended to; the efforts of the operator muſt be ſlow and gradual; and thus the utmoſt rigidity in the ſoft parts will, in time, be overcome.

7. The hand muſt be introduced only during the remiſſion of pain; when pain comes, the accoucheur muſt always reſt; otherwiſe he may puſh his hand, or the fœtus, through the body of the uterus.

8. In puſhing up, to come at the feet, this muſt never be done with the points of the fingers, nor with the hand clenched, but with the palm of the hand or the broad expanded fingers, and always during the remiſſion of pain, and the latter ſhould alſo be obſerved in bringing down the legs; but, in making the extraction of the body, the efforts of the operator ſhould always co-operate with thoſe of nature.

9. The hand ſhould, if poſſible, be introduced along the anterior parts of the child; and both feet, if eaſily come at, ſhould be laid hold of.

10. In turning, the accoucheur ſhould never conſider the child as dead, nor allow himſelf to be deceived by ſymptoms doubtful and fallacious; the child is ſometimes born alive when he would leaſt of all expect it; therefore, in puſhing up, bringing down the legs, or extracting the body, it ſhould be handled with the greateſt delicacy.

11. When the hand is within the pelvis, it ſhould not always be moved in the line of the umbilicus but rather towards one ſide of the ſpine, by which more room is gained, and the prominent angle of the ſacrum avoided.

12. The hand ſhould be paſſed as far as the middle of the child's body, before attempting to ſearch for the feet or before attempting to break the membranes, ſhould theſe remain entire, till the aperture of the uterus will admit of the hand.

13. If the hand cannot paſs the preſenting part of the child to come at the feet, inſtead of violently puſhing back, the part ſhould be as it were lifted up in the pelvis, and moved towards a ſide; by which means difficulties may be ſurmounted, and great danger often prevented.

By attending carefully to the above rules, laceration of the uterus, floodings, convulſions, inflammations, and their conſequences, may be prevented; accidents that frequently happen in the hands of ignorant raſh operators.

Caſe 1.—*The arm preſenting.* The right is to be diſtinguiſhed from the left by laying hold of the child's hand, in the ſame manner as in ſhaking hands; and thus the general poſition of the child may be judged of.

When the accoucheur is called in early, the reduction is generally practicable; but if the arm protrudes through the vagina, and the ſhoulder be locked in the pelvis, it is needleſs, by fruitleſs efforts, for the accoucheur to fatigue himſelf, and diſtreſs his patient to attain a point by which he will gain no very material advantage; as the hand can be paſſed into the uterus by the ſide of the child's arm, which will, of courſe, return into the uterus when the feet are brought down into the vagina.

In order to make the delivery, the hand of the accoucheur, well lubricated, muſt be conducted into the uterus by the ſide of the child's arm, along the thorax, at the oppoſite ſide of the pelvis where the head lies; if any difficulty occurs in coming at the feet, this hand muſt be withdrawn, and the other introduced in its ſtead; and if ſtill the hand cannot eaſily paſs beyond the child's head or ſhoulder, the preſenting part muſt be raiſed up, or gently puſhed to a ſide, that one or both feet may be laid hold of, which muſt be brought as low as poſſible, puſhing up the head and ſhoulders, and pulling down the feet alternately till they advance into the vagina, or ſo low that a nooſe or fillet can be applied; and thus by pulling with the one hand by means of the nooſe, and puſhing with the other, the feet can be brought down and the delivery finiſhed, however difficult.

The method of forming the nooſe is by paſſing the two ends of a tape or garter through the middle when doubled; or, ſhould the garter be thick, by making an eye on one extremity, and paſſing the other end through it; this mounted on the points of the fingers and thumb of the accoucheur's hand, muſt be conveyed into the uterus, paſſed over one or both feet and ankles, and ſecured by pulling at the other extremity.

Caſe 2.—*The ſide.* This is diſcovered by feeling the ribs.

Caſe 3.—*The back.* This is diſcovered by feeling the ſpine.

Caſe 4.—*The belly.* This is known by the funis.

Theſe caſes occur rarely, as the uterus muſt with difficulty admit of ſuch poſitions. When any of theſe parts do preſent, the child ſeldom paſſes any part of the brim of the pelvis, and is, in general, more eaſily turned than in ſeveral poſtures in which it may offer. The belly, from the difficulty with which the legs can be bended backwards, except the child be flaccid, putrid, or before the time, will very ſeldom directly preſent; if ſo, it will be early and readily diſcovered by the prolapſus of the funis, and there will be no great difficulty to come at the feet, and deliver. The rule in all theſe caſes is, to paſs the hand into the womb in the gentleſt manner poſſible, and to ſearch for the feet and bring them down.

CLASS III.

When the child lies longitudinally, in the uterus, with the arm or ſhoulder preſenting, and the head more or leſs over the pubes, or laterally in the pelvis, the feet towards the fundus uteri, the waters evacuated, and uterus contracted round the child's body; theſe are the moſt difficult and laborious of all the caſes of preternatural labours. Here the protruding arm ought, if poſſible, to be reduced, and the head brought into the pelvis; for unleſs the child be very ſmall, it is impoſſible for the head and arm to paſs along together.

In order to effect the reduction of the arm, different inſtruments have been invented; but the hand of the accoucheur is preferable to every thing of this kind, whether of ancient or modern invention. This, conducted by the arm that protrudes, muſt be inſinuated through the vagina into the uterus, as far as the ſhoulder of the child, which if the accoucheur can raiſe up, he will generally ſucceed in reducing the arm

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arm. Should this method fail, he muſt attempt to puſh up the fore-arm at the elbow; but, in bending it, muſt be very cautious, to avoid overſtraining or diſlocating the joint. In whatever manner the reduction is accompliſhed, if any method proves ſucceſsful, the arm muſt be retained, till the head, by the force of natural pain, enters the pelvis, and prevents its return; otherwiſe the arm will deſcend as often as it is reduced.

But if the attempts for reduction prove impracticable, the woman muſt be placed on her knees and elbows, and the accoucheur, with great deliberation muſt endeavour gently to ſlide up his hand between the uterus and child as far in the uterus as poſſible, to lift up the head and ſhoulders, and ſearch for and bring down one or both feet, in the beſt manner the various circumſtances of the caſe will admit of. As ſoon as they can be laid hold of, they muſt be gradually brought down into the vagina, ſo low that the nooſe can be applied over them, which muſt be fixed and pulled with the one hand, while the head and upper parts of the body are raiſed and gently puſhed up with the other.

Should the arm have been long protruded without the os externum, much ſwelled, and cold; the waters drained off; the uterus ſtrongly contracted; and the poſition of the child ſuch as to render it impracticable, either to reduce the protruded limb or to ſearch for and bring down the feet; the head if eaſily come at, muſt be opened and extracted with the blunt hook or crotchet; or a crochet muſt be fixed amongſt the ribs, and the breech or feet thus pulled down.

Should the pelvis be very narrow, and unſurmountable difficulties occur, the arm muſt be twiſted off at the elbow, though this expedient is rarely neceſſary; and the delivery muſt in general be accompliſhed as the prudence and judgment of the operator can beſt direct; always remembering, when one life muſt fall a ſacrifice, that the tree muſt be preſerved at the expence of the fruit.

In this, as in other caſes, the ſwelling and coldneſs of the arm, and even want of pulſation in the artery, are not infallible ſigns of the child's death; and ſhould this even be ſo, it makes little difference in the mode of delivery, unleſs that it will lead us to pay all our attention to the mother: For a living child gives no more aſſiſtance in the birth than a dead one, whatever authors have ſaid to the contrary.

When both arms preſent, the delivery muſt be conducted in the ſame manner as when one only preſents. The former caſe is leſs difficult than the latter, as the head ſeldom advances far when both arms fall into the paſſage, ſo that they can either be reduced or there is eaſy acceſs to come at the feet to bring them down and deliver.

CLASS IV.

When the membranes remain entire, till the ſoft parts are ſo much dilated that the hand will readily find admittance; or when the hand can be paſſed within the cavity of the uterus, immediately after the rupture of the membranes, ſo that part of the water may be retained; the delivery may be acompliſhed, in the moſt troubleſome preternatural caſes, with the greateſt ſafety and expedition. But when the waters have been long evacuated, and the uterus, cloſely contracted round the body of the child, the caſe will prove laborious to the operator, painful and dangerous to the mother and child.

When there is reaſon to ſuſpect that the child lies acroſs, which can often be aſcertained, either by feeling the preſenting part through the membranes, or by ſome of the ſigns of preternatural labours already mentioned; the woman ſhould be managed in ſuch a manner, that the membranes may be preſerved entire as long as poſſible: for this purpoſe ſhe ſhould keep quiet in bed, and her poſture ſhould be ſuch as is leaſt favourable for ſtraining, or exerting force during the pain: ſhe ſhould be touched as ſeldom as poſſible, till the os internum be ſufficiently dilated. The acoucheur ſhould then introduce his hand in a conical form, well lubricated, into the vagina, and through the aperture of the internal orifice, inſinuating it between the uterus and the membranes, till it advances almoſt as high as the fundus uteri, when he muſt break the membranes, by pinching ſome part of them between a finger and thumb, or by forcibly puſhing a finger thro' them; he muſt then ſearch for, and endeavour to lay hold of, one or both feet, and deliver.

Should the membranes be ruptured in the attempt he muſt be ready to run up his hand as quickly as can be done with ſafety, when, part of the waters by his arm being retained, the operation of turning will be facilitated. Should the placenta adhere on that ſide of the uterus where the hand is paſſed, it muſt again be withdrawn, and the other hand be introduced in the oppoſite ſide.

Floodings. It has been already obſerved, that a flooding ſeldom proves fatal to the mother before the ſeventh month of pregnancy; after which period, from its duration or exceſs, the life of both the mother and child may ſuffer. Should therefore a flooding attack a woman in the two laſt months of pregnancy, from whatever cauſe it may ariſe, and whether attended with labour-pains or not, if the hæmorrhagy be ſo conſiderable that ſhe is ready to ſink under it, and that cold applications and other means of checking the evacuation ſhall fail, the woman muſt be placed in a proper poſture, her friends prudently appriſed of her danger, and the delivery muſt be immediately performed, by ſtretching the vagina and os uteri, till the hand of the operator can eaſily gain admittance to break the membranes, catch hold of the feet, and extract the child.

If it can poſſibly be prevented, the membranes in flooding caſes ſhould never be broken till the aperture of the uterine orifice will freely admit the hand to paſs, that after the evacuation of the waters, the accoucheur may have it in his power either to make the delivery or not according as the effuſion continues or abates.

Soon after attempting to ſtretch the parts, ſhould the labour-pains come on, the waters begin to be collected, and the uterine hemorrhagy diminiſh the accoucheur muſt then withdraw his hand, and manage the delivery according to circumſtances. And if, for inſtance, the child preſents naturally, the delivery muſt be truſted to nature; otherwiſe, if the flooding continues, or the child preſents acroſs, the accoucheur muſt perſiſt in his work, going on ſlowly, and with the utmoſt

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most delicacy, till he be able to reach the feet, to bring them down, and deliver; always remembering, during this process, that the strength of the woman, by proper nourishment, be supported.

But should the placenta adhere to the cervix, or upon the os uteri, the greatest danger is to be dreaded; for thus the flooding will commence from the moment the os uteri begins to stretch, and will increase so rapidly, that the woman, if not speedily delivered, must inevitably sink under it. The whole body of the placenta, in such cases, is sometimes separated when the labour has made but little progress; so that the woman will often perish whether delivery be attempted or not. As this, however, is the only expedient by which her life, and that of the child, can be saved; in every case where the placenta presents, which the accoucheur will readily discover by the touch of the soft pappy substance of that body, he must immediately place the woman in a proper posture, insinuate his hand gently by the side of the protruding placenta, break the membranes, search for the feet of the child, and bring them down, so that the delivery may be finished with all possible expedition; for, in this unhappy case, a few minutes delay may prove fatal.

The after-birth ought never to be extracted before the child, if it can possibly be avoided.

After delivery, time should be given for the uterus to contract, that nature may thus throw off the placenta, which never ought to be hurried away, unless the continuance or a recurrence of the hemorrhagy render it necessary.

Prolapsus of the funis. Difficulties arising from the funis falling down into the vagina, and presenting along with some part of the child, may, in this class of the division of preternatural labours, be included.

A pressure on the chord, in such a degree as to interrupt the circulation, must infallibly destroy the life of the child: hence a coldness and want of pulsation in the chord is the truest criterion of the death of the child; and hence, in every case where the chord is prolapsed before any bulky part of the child, if the delivery be not accomplished with expedition, the child will perish. This is only to be prevented by replacing the chord, and retaining it above the presenting part, till this last, by the force of labour-pains, be so far advanced as to prevent the return of the former; or the child must be turned and brought by the feet, provided this can be done with safety to the mother. But it is often difficult to succeed in the attempt of the one or other; and, if the woman has strong pains, such attempts are not to be hazarded, as the consequences may prove fatal.

When the accoucheur is thus situated between two puzzling difficulties, the preference must always be given to the mother. If the child be small, and the pelvis well formed, which may be known by the history of former deliveries, and if the labour goes on quickly, the child will generally be born alive; but if, on the contrary, the child be above the ordinary size, and the pelvis rather narrow, turning will prove a dangerous operation to the mother, and there is little prospect of saving the infant by this means.

Besides our former division of labours, *plurality of children, monsters, extra-uterine fœtuses*, and the *Cæsarean operation*, are parts of the subject that yet remain to be considered.

Plurality of Children.

Chap. IV. *Plurality of Children.*

The case of twins often occurs: of triplets seldom: of quadruplets rarely: nor is there perhaps a single instance, where five or more distinct fœtuses have been found contained in the human uterus, though many such fabulous histories have been recorded by credulous authors.

The signs of two or more children, such as the sudden or extraordinary increase of the uterine tumor, motion felt in different parts of the abdomen, &c. are very doubtful and fallacious: this can only be ascertained after the delivery of one child; and even then a recurrence or continuance of labour-pains is not a certain and infallible criterion; neither is the absence of pains a sure indication of the contrary; as many cases have occurred, where several days have intervened between the birth of a first and second child. The chief symptoms to be depended on are, 1st, The child being of a small size, and the quantity of liquor amnii so inconsiderable as not to account for the bulk of the woman in time of pregnancy. 2dly, The bleeding of the funis umbilicalis next the mother. 3dly, The remora of the placenta. 4thly, The uterine tumor not sensibly diminished, which, very soon after delivery, in ordinary births, will be found gradually shifting lower and lower, and will feel at last as if a hard circumscribed tumor like a ball between the umbilicus and pubes. Hence the utility of the general practice of applying the hand externally on the abdomen, in every case after delivery; by which an accurate knowledge will be formed of the nature and manner of the uterine contraction. When, from any of these circumstances, there is reason to suspect another child, the most certain and infallible manner of discovering it is, the passing of a finger, or the introduction of the hand into the uterus, where another set of membranes will be perceived, and probably some part of the child presenting through them.

The position of twins or triplets is commonly that which is most commodious, and which will occupy the least room in utero: their situation is often diagonal; tho' they may present in every possible posture. Thus, therefore, the general rules recommended for the delivery of one child, are equally applicable in the case of twins, triplets, &c.

It has been the general practice with many, after the birth of one child, to pass the hand immediately into the the uterus, to break the membranes, catch hold of the feet of the child, and thus deliver. But this is certainly bad practice, whatever authors have said to the contrary. If the woman is healthy, and the child presents favourably, that is, with the head, breech, or feet, natural pains ought to be waited for, when the child will be expelled by the force of these only; failing which, manual assistance, as in other cases, must be had recourse to.

It very rarely happens, when the first birth is preternatural, that the second membranes are ruptured in making the extraction. Should this prove the case, the

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limbs of the children may be confounded, so that a leg and an arm, or three legs, or arms of different children, may present; which, however will make little difference in the mode of delivery; the accoucheur will endeavour to lay hold of the foot or feet most readily within his reach, and will be cautious, in bringing them down, to make sure they belong to the same body.

If the child presents cross; if floodings, convulsions, or other dangerous symptoms, shall take place; if the woman has suffered much in the first labour; and if, after several hours, a recurrence of labour-pains does not ensue; the hand must then be introduced into the uterus, the membranes must be broken, and the child must be extracted by the feet; or, if the head remains locked in the pelvis, and, from want of strength in the woman, cannot be expelled, the treatment is the same as in other laborious births.

In twin-cases it may be recommended as a general rule to avoid precipitating the delivery of the second child till the woman shall have rested a proper time, and till, by the contraction of the fundus uteri, the second set of membranes occupy the place of the first, and be protruded as far as the os externum; when, and not before, the delivery may safely be assisted, should circumstances occur to render such assistance necessary: whereas, by breaking the membranes and evacuating the waters when the child lies high in the uterus, a flooding may be brought on, or a spasmodic constriction of the uterus round the body of the child may be occasioned, which may render the delivery both difficult and dangerous.

The placentæ of twins, triplets, &c. generally adhere, though sometimes they are distinct, and may be thrown off at different times after the birth of the different children; so that the practitioner should be on his guard, and never should leave his patient till he makes sure there be no more children. When a second child is discovered, no attempts ought to be made to extract the placenta till after the birth of the remaining child or children; as the woman would be subject to flooding, which might prove of fatal consequence before the uterus could be emptied of its contents.

In case of plurality of children, a second ligature should be applied on the funis, on that end next the mother, immediately after the birth of every child; and a gentle compression should be made on the abdomen of the woman after the first delivery, which must be gradually tightened after every succeeding one, to prevent the consequences of a sudden removal of uterine pressure, which is to be dreaded where the distension has been considerable.

The placenta, in such cases, must be managed in much the same manner as usual. In twins, &c. it generally separates with great facility, provided time has been given for the uterus to contract. Both chords should be gently pulled; and when it advances towards the uterine orifice, where, being large and bulky, it commonly meets with considerable resistance, it requires the introduction of a finger or two into the vagina for bringing down the edge, after which the body readily follows.

Chap. V. *Monsters.*

These are of various sizes and forms, and, unless very small, the posture favourable, and the woman well made, will prove the cause of a difficult and troublesome delivery. Sometimes a child is monstrous from a preternatural conformation of parts, such as a monstrous head, thorax, abdomen, &c. At other times, there is a double set of parts, as two heads, two bodies with one head, four arms, legs, &c. But such appearances very seldom occur in practice; and, when they do, the delivery must be regulated entirely according to the circumstances of the case. A large head, thorax, or belly, must be opened. If two bodies united together are too bulky to pass entire, they must be separated; the same of supernumerary limbs. If the posture be unfavourable, it must be reduced when practicable; otherwise the extraction must be made with the crotchet, in the best manner the circumstances of the case will admit of; always in cases of danger or difficulty, giving the preference to the safety of the mother, without regarding that of the child.

Cæsarean Operation.

Chap. VI. *Cæsarean Operation.*

When the delivery could not be accomplished by other means, or when a woman died suddenly with a living child in her belly, an operation to preserve the life of mother and child in the former case, and to save the child in the latter, has been recommended, and successfully performed, by different authors, and in different ages.

This operation is of ancient date; it is the *sectio Cæsarea* or *partus Cæsareas* of the Latins, and the *hysterotomia* of the Greeks. Whether it was ever successfully performed on the living subject amongst the ancients seems uncertain; but that it has been successfully practised by the moderns on various occasions, and in several different countries of Europe, there are so many authentic histories on record, that the fact will scarce admit of doubt: but as this, like many other salutary institutions, has been much abused, and in many cases improperly and injudiciously employed, (for some of those women who survived the operation, were afterwards safely delivered of living children), the circumstances which render this operation necessary demand a very particular inquiry, viz.

1. A narrowness, or bad conformation of the bones of the pelvis.
2. Imperforated vagina, or contractions in the vagina, cicatrices, tumors, or callosities in the os uteri, &c.
3. The escape of the child through the uterus when torn.
4. Ventral conceptions.
5. Herniæ of the uterus.
6. The position or bulk of the child.

It will be necessary carefully to examine these different causes, in order to show that they are by no means, in every case, sufficiently powerful motives for having recourse to it.

I. Bad confirmation of the bones of the pelvis. When the hand of the operator cannot be introduced within the pelvis; or, in other words, when its largest diameter does not exceed one inch, or one inch and a half, this conformation is perhaps the only one which renders the Cæsarean operation absolutely necessary: happily, however, such a structure very seldom occurs in practice; and when it does the accoucheur will readily

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readily discover it, by attending to the following circumstances, and to the common marks of a narrow pelvis. Wherever the capacity of the pelvis is so strait as not to admit any part of the child's head to enter, nor two fingers of the accoucheur's hand to conduct proper instruments to tear, break down, and extract the child piece-meal; in this case, recourse must be had to the Cæsarean section; an expedient, though dreadful and hazardous, that will give the woman and child the only chance of life; and which, if timely and prudently conducted, notwithstanding of the many instances wherein it has failed, may be performed with some probability of success.

It is true, the success of the operation in the city of Edinburgh, where it has been done five times, has proved discouraging, as none of the women had the good fortune to survive it many days. This, however, is not the fault of the operation, but is to be imputed to the low, weak state of the patients at the time, who had previously been several days in labour, and their strength greatly exhausted, before the operator was called. Delivery by every other means was utterly impracticable; the operation, though the event was doubtful, alone gave a chance of life; and three of the children by this means were extracted alive.

Mr Hamilton surgeon and professor of midwifery in Edinburgh, having been an eye witness of the operation the last time it was performed here, gives the following account of the case which fell under his observation.

Elisabeth Clerk, aged 30, had been married for several years, became pregnant, and miscarried in the third month; the expulsion of the abortion occasioned so severe a stress, as actually to lacerate the perinæum. Some time after her recovery, she was irregular, afterwards had one show, of the menses, again conceived and the child as she imagined, arrived at full time. She was attacked on Monday the 3d of January 1774, about midnight, with labour-pains, which went on slowly, gradually increasing till Saturday the 15th, when she was brought from the country to the Royal Infirmary here. Upon examination, the pelvis seemed considerably distorted; but the body was otherwise well shaped, though of small size; the os externum vaginæ was entirely shut up, nor could any vestige of vagina be observed, nor any appearance of labia pudendorum: instead of this, there was a small aperture at the superior part of the vulva, immediately under the mons veneris probably about the middle anterior part of the symphysis pubis. This aperture (which had a small process on the superior part, somewhat resembling the clitoris) was no larger than just to allow the introduction of a finger; the meatus urinarius lay concealed within it; a consultation of surgeons was called, and the Cæsarean section was determined on. Having had no stool, nor voided any urine for two days, an injection was attempted to be thrown up: but it did not pass, nor was it possible to push the female catheter into the bladder. Mr William Chalmer was the operator in this case. At six in the evening, he made an incision on the left side of the abdomen in the ordinary way, through the integumens, till the peritonæum was exposed; two small arteries sprung, which were soon stopped by a slight compression: the wound was then continued through the peritonæum into the cavity of the abdomen, when the bladder appeared slightly inflamed, much distended, reaching with its fundus near as far as the scrobiculus cordus; another unsuccessful attempt was made to pass the female catheter; at length a male catheter was procured, which was, after some difficulty, introduced into the bladder, and the urine evacuated to the quantity of above four pounds, high-smelled and fetid. This occasioned a necessary interruption for a few minutes, between making the opening, into the abdomen and uterus; the bladder collapsing, the uterus, which before lay concealed, now came in view, through which an incision was made, and a stout male child was extracted alive; and immediately afterwards the secundines. The uterus contracted rapidly. After cleansing the wound, the lips were brought together by the quill-suture, and dressed superficially. The patient supported the operation with surprising courage and resolution; nor was there more than five or six ounces of blood lost on the occasion.

Being laid in bed, she complained of sickness, and had a slight fit of vomiting; but, by means of an anodyne, these symptoms soon abated: she was affected with universal coldness over her body, which also abated on the application of warm irons to the feet: she then became easy, and slept for four or five hours. Next morning, the 16th, about two o'clock, she complained of considerable pain in the opposite side, for which she was blooded; and an injection was given, but without effect; for the pain increased, stretching from the right side to the scrobiculus cordis; nor did fomentations seem to relieve her; her pulse became frequent, she was hot, and complained of drought. At 7 A. M. the injection was repeated, but with no better success; and eight ounces more of blood were taken from the arm; a third injection still failed to evacuate any fœces: the drought increased; and the pulse rose to 128 strokes in a minute. At 11 A. M. the pulse became fuller; and the respiration much oppressed. No stool nor urine passed since the operation. At 12 she was blooded again, when the sizinesS appeared less than formerly. She now took a solution of *sal Glauber. manna and cr. tart.* at short intervals; she vomited a little after the last dose, had a soft stool, and voided a small quantity of urine. At 3 P. M. her pulse was 136, and she had another stool, when thin fæces were evacuated; she was then ordered two spoonfuls of a cordial anodyne mixture every second hour: the vomiting now abated; the pulse became smaller and more frequent: she passed urine freely; but the pain and oppressed breathing increased. At seven P.M. her pulse rose to 142, and became weak and fluttering; she called for bread, and swallowed a little with some difficulty; her drought was intense; the dyspnœa still increased. She was now much oppressed, and began to toss; the pulse sunk and became imperceptible; she complained of faintishness, but on belching wind her breathing was relieved, and the pulse returned, growing fuller and stronger: the pain of the side still increasing, 12 ounces of blood, very sizy, were taken away; and two glysters of warm water with oil were injected without effect; at 8 P. M. the pulse became less frequent and smaller; she complained much of the pain towards the scrobiculus cordis: her breathing was much oppressed; her belly was tense, and swelled as big

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big as before the operation; her pulse was now small and feeble; she looked ghastly, and expired a little after eight, 26 hours after the operation.

It is to be regretted that the relations would not permit the body to be opened.

Since the first certain accounts of the operation successfully practised by a sow-gelder, on his own wife, in the beginning of the 16th century, there are on record above 70 well-attested histories, wherein it has been successfully performed: for, of all the cases related by authors it has not proved fatal to the patient above once in ten or nine instances; which evidently shows the propriety of the practice, and probability of success, both in regard to the mother's own recovery, and for certainly preserving the life of the child. But it should never be attempted, excepting in those cases only where it is absolutely impossible to deliver the woman by any other means whatever; for there are pelvises to be met with, where, without having recourse to this operation, both mother and child must inevitably perish: such have occurred to many practitioners, who, from want of resolution or from ill founded prejudice, have allowed their patients to perish from neglect, contrary to a well-known maxim in physic, That in a desperate case, it is better to employ a doubtful and even desperate remedy than to abandon the patient to certain and utter ruin. Such, for instance, is a case related by Saviard, of a girl aged 27, whose stature was only three feet, who came to lie-in at Paris, in the *Hotel Dieu;* every method but the operation was in vain attempted; both mother and child died. Mauriceau also relates the history of a woman who was left to die, where the aperture of the pelvis was so small as not to admit the hand of the accoucheur. And, not to multiply instances, Mr De la Roche gives a case where the woman had been seven days in labour; the child was saved by the operation but the woman died the fifth day after, probably from its being too long delayed: the distance, in this subject, from the lower vertebra lumborum and os pubis, was no more than two fingers breadth. The operation, when the necessity is evident, ought therefore to be early performed, that the patient, who from her make and constitution is generally delicate and puny, may have every chance of recovery in her favour without being exhausted by the fruitless efforts of a tedious and painful labour, as too often has been the case. On these occasions, the prudent accoucheur should call in the advice of his elder brethren of the profession, and, by his cautious and prudent conduct, avoid every cause of censure or reproach.

Exostoses from the bones of the pelvis is a species of deformity very rarely met with in practice, and which seldom or never takes place to such a degree as to render this operation necessary.

II. Constriction, callosity, tumors, &c. about the vagina or os tincæ. The vagina and os tincæ are often affected with constrictions from cicatrices, with callosities and tumors: but it is seldom, if ever necessary to perform the Cæsarean section on this account. Tumors in the vagina may generally be removed with safety, even after the commencement of labour, and delivery happily succeed; or it may be sometimes practicable for the accoucheur to pass his hand by the side of the tumor, to turn the child, and deliver. With regard to constrictions in the vagina, and callosities in the os uteri, there are many instances where, at the commencement of labour, it was impossible to introduce a finger into the vagina; yet the parts have dilated as labour increased, and the delivery terminated happily. At other times, the dilatation has begun during pregnancy, and been completed before delivery. There is a history, for instance, in the *Mem. de l'Acad. des Scienc.* 1712, of a woman whose vagina was no larger than to admit a common writing quill; she had been married at 16, and conceived 11 years after: towards the fifth month of her pregnancy, the vagina began to dilate, and continued to do so till full time, when she was safely delivered. Guilemeau dilated, and La Mott extirpated, callosities in the vagina and os tincæ, when the children were successfully expelled by the force of natural labour.

Harvey relates a case where the whole vagina was grown together with cicatrices; nature, after a tedious labour, made the dilatation, and a large child was born.

La Mott mentions his having delivered three women, who had not the smallest vestige of an orifice through the vagina to the uterus. Dr Simpson cut through a callosity of an os uteri which was half an inch thick, &c.

Upon the whole, tumors in the vagina, or about the orificium uteri, may be safely extirpated without danger of hemorrhagy or other fatal symptoms, and the delivery will happily succeed; and if the vagina be impervious, the os externum shut up, or the labia grown together, the parts should be opened with the scalpel, rather than risk an operation, at best in the issue doubtful and precarious; an operation never allowable in such cases, and therefore universally improper in diseases or malconformation of the soft parts of generation. If the os externum be entirely closed, if the cavity of the vagina be entirely filled up, or the passage considerably obstructed by tumors, callosity, or constriction from cicatrice, and there is no reason to suspect a fault in the pelvis, of which a judgment may be formed by the common marks of deformity, under size, or a rickety habit; it is by much the best practice to open a passage through the vagina, and deliver the woman in the ordinary way. If there be no defect in the pelvis, the head of the child, or any other bulky part that presents, will advance in this direction, till it meets with a resistance in the soft parts: thus the teguments will at length be protruded before the child's head, in form of a tumor, when a simple incision downwards to the perinæum, in the direction of the anus, will remove the cause of difficulty, by relieving the head; the child will afterwards safely pass, and the wound will heal without any bad consequence.

The state of the pelvis, and progress of the labour in these cases, may often be learned by the touch of the finger in ano.

III. Laceratad uterus is another cause for which this operation has been recommended. The uterus may be ruptured from violence in making the delivery; or such an accident may happen naturally, either from the cross presentation of the child in time of pregnancy, or in time of labour, when the pelvis is narrow; these cases are generally fatal; and it is very seldom,

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if ever, that the life of the mother can be saved by the Cæsarian section, after the fœtus escapes through the torn uterus into the cavity of the abdomen: because it often happens, that inflammation and sphacelus has affected the parts of the uterus that sustained the pressure previous to the rupture; or, if otherwise, convulsions or other fatal symptoms soon ensue, from the quantity of blood, waters, &c. poured into the cavity of the abdomen.

When the child cannot be extracted by the natural passages, tremors, singultus, cold sweats, syncope, and the death of the mother, for the most part, so quickly follow, that it will at least seem doubtful, to a prudent humane practitioner, how far it would be adviseable, after so dreadful an accident, the woman apparently in the agonies of death, rashly to perform another dangerous operation, even with a view to preserve the child, till he had waited till the mother recruits or expires.

If part of the child be contained within the uterus, and the feet can be reached, the practice is to deliver by the orifice of the womb; but when the whole fœtus has escaped entirely without the uterus, the Cæsarean operation is recommended as the only means of preserving both mother and child.

If the operation on this occasion be ever allowable, it may be asked,

1. At what time must it be performed?

2. Would it not have the appearance of inhumanity to have recourse to this expedient immediately after the uterus bursts, when the woman is seemingly ready to expire, although it be the only time when there is a chance of saving the child?

3. In most cases where this accident happens, should the Cæsarean section be made, is it not highly improbable that the mother will survive so terrible a laceration?

5. For if it be done with a view to save the mother, in what manner is the extravasated blood, &c. to be evacuated from the cavity of the abdomen?

What seems to make cases of this kind unfavourable, when the accident happens in time of labour, is,

1*mo*, That here the parts before rupture in most cases are in a gangrenous state.

2*do*. As the rupture is commonly towards the cervix, there is generally a much greater hemorrhagy, by reason of the slow contraction of the uterus at this place.

3*tio*, The uncertainty whether, or how long, the patient will survive it, seems also a considerable obstacle to the operation under such disagreeable circumstances, *Ne occidisse videatur, quem sors interimet*.

IV. Ventral conceptions is a fourth indication for this operation. These are either in the ovaria, tubes, or cavity of the abdomen, and seldom arrive at great size; or are retained, very often a long time, without occasioning much complaint. The issue of these conceptions has also been no less various than extraordinary; for after being retained for a great many years in an indolent state, at length abscesses or ulcerations have formed, and they have been discharged throughout all the different parts of the abdomen.

Most women feel pain and violent motion at the time of ordinary delivery in these cases of ventral conception; if therefore the operation be ever necessary, now is the proper time to perform it. But in general as the separation of extra-uterine fœtuses from their involucra may occasion immediate death in many cases, from the vast hemorrhagy that might ensue from the non-contractile power of the parts to which they adhere; unless they point outwardly, or excite the most violent symptoms, they ought universally to be left to nature.

V. Herniæ of the uterus are seldom or never sufficient to induce us to perform the Cæsarian section, as the uterus is very rarely influenced in such a manner that the orifice cannot be reached, and the delivery successfully made. Many instances are to be found among surgical authors, where deliveries, under such circumstances, have been happily performed, without having recourse to so hazardous an expedient. Thus Mauriceau mentions a case, where the uterus in a ventral hernia, was pushed along with the intestines above the belly, and contained in a tumor of a prodigious size; the woman, however, was delivered at the end of her time in the ordinary way. La Mott relates the history of a woman in a preternatural labour, whose uterus and child hung down pendulous to the middle of her thigh, but whom notwithstanding, he safely delivered: and Ruysch gives a case where the midwife reduced the hernia before delivery; although it was prolapsed as far as the knee, the delivery was safely performed, and the woman had a good recovery.

Lastly, The position or bulk of the child.

Since the practice of turning the child and delivering by the feet, and the late improvement of obstetrical instruments, this operation is never to be performed on account of position, monstrosity, or any other obstacle on the part of the child.

Upon the whole, when the pelvis is faulty to such a degree, that no instrument can be conducted to tear and exact the child, this perhaps is the only case wherein this operation should be performed on the living subject. Incisions through the teguments of the abdomen to extract extra uterine fœtuses, or bones of fœtuses, do not properly fall under the name of *Cæsarean section*, as that name implies incision of the uterus also.

When a woman advanced in pregnancy dies suddenly, either by accident or by natural disease, the Cæsarean section is recommended as an expedient to preserve the life of the child. This is a very proper measure, provided the death of the mother be ascertained; but sometimes it is a very nice and difficult point to distinguish between a deliquium and death; and therefore the accoucheur on such an occasion must act with the utmost circumspection. If the operation be delayed but a very short while after the mother expires, it will probably be in vain to make the attempt; for, whatever fabulous stories may be related to the contrary, there are few authentic cases of the fœtus of any animal surviving the mother, perhaps an hour; and therefore every thing should be in readiness to extract the child with all possible expedition, after the event of the mother's death. But, in such cases, the agonies of death often perform the part of labour, and the child is sometimes thrown off *in articulo mortis*; or the os uteri is so much dilated, that there is easy access to pass the hand, turn the child, and deliver. Thus one should be very cautious in having recourse to this opera-

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operation, even in the above circumstances; which should never be done,

1. Till the death of the mother be ascertained beyond doubt;

2. Till the state of the os uteri be examined;

3. Till the consent of the relations be obtained; And,

Lastly, It need not be undertaken, except where the mother dies suddenly, between the 7th and 9th month.

It is unnecessary where the disease has been lingering; in such cases the child commonly dies before the mother.

When it is doubtful whether the child be alive or not, it may be determined by applying the hand on the abdomen of the mother about the time of, and for a little while after, her death, when the life of the child will be discovered by its motions and struggling.

Thus having pointed out the different causes that determine this operation, it may be observed, that it is a frightful and hazardous one; and although performed successfully in a number of cases, yet, in many others it has failed, and the woman has died either immediately or soon after. It should never, therefore be undertaken but on extraordinary and desperate occasions; and then it is not only adviseable, but incumbent, on every practitioner to whom such cases occur.

To conclude, it may not be improper to give a few directions with regard to the method of performing the operation on the living subject.

Having emptied the bladder, and evacuated the contents of the intestines with repeated emollient glysters; the patient being encouraged, with proper cordials, and every other requisite in readiness, she must be placed on a table or bed, with her left side gently raised with pillows or bolsters, and properly secured by assistants. An incision must be made with a common convex scalpel, beginning rather below the navel at the middle space between it and the spine of the os ilium, carrying it obliquely forwards towards this bone, so that the wound in length may exceed six inches. This external wound is to be carried through the common teguments of the abdomen till the peritonæum is exposed, when the operator should rest a little, till the hemorrhagy be entirely abated. He must then, with great caution, make a small opening through this membrane, introduce his finger, and upon this a scalpel (which is preferable to scissars), and with great expedition make a complete dilatation; he must now wipe away the blood with a sponge, press the omentum or intestines gently to a side, if in the way, and endeavour to discover to what part of the uterus the placenta adheres, that it may be avoided in making the incision. This may easily be known by a thickness and solidity in the part, which distinguish it from the rest of the uterus: it is still more easily discovered when the membranes are entire. The blood-vessels are less in number, and smallest in the middle and anterior part of the uterus, which therefore, if the placenta does not interfere, is the proper place for making the incision, which must be performed with the utmost attention, lest the child should be wounded: if the membranes are entire, more freedom may be used, and *vice versa*. The direction and length of the wound of the uterus must be the same with the external one. The child must now be quickly extracted, and the placenta carefully separated: these must be given to an assistant, who will divide the chord, and take care of the child, as the operator's attention must be wholly bestowed on the mother. The coagulated blood, &c. being removed by a sponge wrung out of warm water (lest the uterus or intestines be protruded, which are very troublesome to reduce), the lips of the external wound must be quickly brought together, and retained by an assistant till secured by a few stitches; generally three will be sufficent: as many needles should be ready threaded with pretty large broad ligatures; the middle stitch ought to be made first; the needle should be introduced at a proper distance, *i. e.* about an inch and one-fourth from the side of the wound, carrying it first from without inwards, and then from within outwards, securing with a double slip a knot, to be ready to untie, lest violent tension or inflammation should ensue; under the knot a soft compress of lint, sharpee or, rolled plaster, should be applied, and the whole dressings must be secured by a proper compress and bandage. The patient must be afterwards treated in the same manner as after lithotomy, or any other capital operation.

Quæritur, To what cause is the unsuccessful event of this operation to be imputed? When the operation proves fatal, to what immediate cause are we to ascribe the death of the patient? Is it nervous, or uterine irritation, from cutting, that kills? Is it internal hemorrhagy, or the extravasation of fluids into the cavity of the abdomen? Or are not the fatal consequences rather to be imputed to the access of the air on the irritable viscera? This can only therefore be prevented by exposing these parts for as short a space of time as possible. Dr Monro, the present anatomical professor at Edinburgh, in making experiments on young small animals, such as bitches, cats, frogs, &c. by opening the cavity of the abdomen, and tying the biliary ducts, remarks, that though a large opening into the abdomen be made by incision, if the wound be quickly closed and stitched, the animal will recover, and no bad consequences follow; but if exposed a few minutes to the air, dreadful pain soon comes on, which the creature expresses by the severest agonies; convulsions at last ensue, and death within four or six hours after the operation. On opening the abdomen after death, the whole viscera are found to be in an inflamed state, and universally adhering to one another. He has often repeated the experiment, and the same appearances as often take place.

May not the analogy here justly apply to the human subject? And, in performing the Cæsarean operation, should we not be very careful that the viscera be exposed as little as possible, and that the wound be covered with the utmost possible expedition?

Chap. VII. *Of the Section of the Symphysis.*

M. Baudelocque, as has already been observed, condemns this operation; and, from what he has advanced, apparently with reason. As no theory, however, can be looked upon as thoroughly established until it be

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be confirmed by experience, this gentleman has collected together a number of the principal *facts* relating to this subject. He supposes, that unless it has been successful in saving both the life of the woman and child, the cutting of the symphysis of the pubes cannot by any means be said to have answered its purpose. It is not sufficient that the child has shown some signs of life at its birth, and that the mother has survived for some time. In this respect the Cæsarean operation has the advantage of it, as it always saves the life of the child, and it is very rare for the woman to sink under it immediately. He is of opinion, that there is scarcely one of the cases of this operation, the relation of which may not be justly contested, or solid objections raised against it; either because the operators have been deceived with regard to the dimensions of the pelvis and of the child's head, or because they have greatly exaggerated the advantage gained by the separation of the bones.—The first and most remarkable instance of success in this operation is of a woman named *Souchot:* but though it is not denied that the woman was delivered, and recovered after the operation, yet it has been said by those who take the contrary side, that there was no necessity for performing it. It is certain that this woman had been delivered four times before; in all of which cases the child was killed. M. Baudelocque does not enter into the merits of this question: he considers only what advantage could possibly be gained by it.

"Whatever degree of separation (says he) took place between the ossa pubis after the section of the symphysis, it must have augmented the size of the passage; that is an incontestible fact: but how much did it enlarge in the direction in which it was originally too narrow? The solution of this problem would be easy, if we knew the dimensions of Souchot's pelvis as well as we know those of her child's head. According to the estimation made of it by the physicians who performed the operation, the diameter of the pelvis was only two inches and a half in the direction from the pubes to the sacrum superiorly, and that of the child's head was just three inches and a half. The excess of the latter was consequently one inch, as well as the amplitude to be procured to the former. A separation of two inches and a half between the ossa pubes, the greatest which it was then thought could be obtained, not being able to give more than six lines to the diameter of the pelvis in the aforesaid direction, they thought to make the remaining surplus of the head pass into the separation between the bones; and, moreover they had the precaution to make the partial protuberances pass successively through the strait, in order to get another line by that means; so that by this system, the section of the pubes produced a result of 13 lines at least, considering it relatively to delivery. Notwithstanding this ingenious calculation, and this great product, the passage was still found narrow enough to give some obstruction to the child's head, and to endanger its life.

"It seems evident that this plan was not formed till after the execution; and that they have only sought to explain what they must have done according to the opinion which they entertained that the diameter of the child's head was an inch larger than that of the pelvis, and not according to what they did and observed: because no one had yet determined the product of a separation of two inches and a half between the ossa pubis, with respect to the different diameters of the pelvis, and particularly respecting that which goes from before backward; because they did not measure the separation as they affirm they did, neither in the case of *Souchot* nor in any other; because the accoucheurs of that woman were then agitated, *much agitated*, as they have publicly confessed; lastly, because this great product, and those sage calculations which we admire in their history of it, were not then necessary. Though they have allowed but two inches and a half to the small diameter of the superior strait, other accoucheurs equally skilful have assigned it six lines more: and they were not deceived if they considered it a little diagonally, as the smallest diameter of the child's head always presents: that is to say, from one of the sides of the projection formed by the base of the sacrum to the symphysis of the pubes."

Our author now goes on to show at great length, that the pelvis of the woman in question was less out of proportion than had been represented; that only two lines of enlargement were necessary and no more than two were obtained. In like manner, he says, that all the other women upon whom M. Sigault operated were equally well formed excepting one named *Vespres*. This woman died after passing five days in great agony. The ossa pubis were separated about an inch and an half; and in consequence of this separation, the sacro-iliac symphyses were plainly injured, as well as the neighbouring parts. On inspecting the body, these were found open, with the periosteum separated from them: there was also a collection of purulent matter of a dark grey colour, extending very far into the cellular tissue of the left iliac fossa, &c.

In this case, both the mother and her child perished; and M. Baudelocque looks upon it to be sufficient to show the inefficacy of the operation: and he tells us, that out of five women whom Sigault delivered in this way, one died, and four of the children; but M. le Roy, a more successful operator, out of an equal number saved all the children. In a case related by this gentleman, the ossa pubis are said to have separated two inches; and by parting the thighs, an opening of near three inches was obtained; but in this case again, M. Baudelocque controverts the measurements of Le Roy. Another woman named *Du Billoy*, on whom the operation was performed, began to walk on the tenth day after: and this seems to be almost the only case against which M. Baudelocque has not some objection. He mentions, however, an experiment performed on the body of a woman who had died on the 11th day after the Cæsarean operation had been performed in the linea alba. The body was œdematous, which rendered the case more favourable; and a dead child was placed in the belly, after taking out the uterus. The pelvis was only 20 lines in the small diameter, and four inches and a quarter in the transverse. The diameter of the child's head was but three inches five or six lines from one parietal protuberance to the other; the trunk was thin, and every part of the body had been pressed and kneaded, to restore as much as possible the suppleness which death had taken away. An attempt was then made to

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to bring the child through the pelvis by pulling its feet; but it was found impossible thus to disengage it farther than the breast. The symphysis of the pubes was then laid bare by an incision of two inches and an half; preserving, below, the anterior commissure of the *labia pudendi*; and above, an extent of 18 or 20 lines under the inferior angle of the Cæsarean operation. The ossa pubis separated at first no more than nine lines; which opening was augmented as gradually as possible to 21 lines by separating the thighs, and afterwards it was farther increased to two inches and a half by pulling the hips. It was next attempted to bring away the head, which had spontaneously placed itself in the most advantageous situation: but, though several gentlemen of the profession employed their strength successively at the trunk, and on the lower jaw with two fingers in the mouth, it did not advance a single line; nor would it pass the strait until M. Baudelocque seconded those efforts by pressing on the head with one hand placed on the belly, and by compressing it strongly in the direction of its thickness. At the instant when it cleared the strait, the inferior angle of the incision in the teguments tore to the vulva; and the wound was so lengthened towards that of the Cæsarean operation, that those three openings were very near making but one. The sacro-iliac symphyses, which were already a little open, and the ligaments and periosteum ruptured by the time that the ossa pubis were separated 21 lines, now gave way entirely, and with so much noise as to be distinctly heard by every one of the assistants. The ossa pubis, after the passage of the head, remained at the distance of three inches from each other; the angle of the right os pubis was two inches and six lines from the centre of the projection of the sacrum, and the angle of the left os pubis only two inches and three lines; so that the diameter of the pelvis was augmented seven lines in one way and ten in the other.

From this experiment, M. Baudelocque concludes, that very little advantage can be expected from the operation where the pelvis presents only 18 or 19 lines, or even 21 superiorly, such as was the pelvis of Belloy. We must observe, however, that we cannot argue with propriety from a dead to a living subject: though if the measurements are wrong, as our author *afterwards* says, although at first he "had nothing particular to object" to her case, the whole argument in favour of the operation must fall to the ground.

Objections of a similar kind are made to every other case which M. Baudelocque relates: And as it is impossible for those who were not acquainted with the parties to judge of the propriety or impropriety of the operation, we shall content ourselves with describing from M. Baudelocque the appearances met with in the body of a woman who had died in the operation. "The left *labium* was very much swelled and livid; the sacro-iliac symphyses were of a brownish colour to the extent of an inch at least, on account of the blood extravasated under the periosteum which was detached from them; they were overflown with a purulent and ichorous discharge, more abundant on the left side than the right; and which sprung from the bottom of them, through several openings, which were so many rents, whenever the ossa ilia were moved and pressed towards the sacrum; the left symphysis was open five lines, and the right only three; a gangrenous abscess was seen on the right side behind and above the acetabulum, which extended to the anterior and inferior part of the uterus; where there was an eschar of the same nature; an ulcer also gangrenous, and in form of a chink, was observed in the posterior part of that viscus, from the upper part of its neck to the insertion of the ligament of the ovarium, and it penetrated into its cavity. The diameter of the pelvis was two inches and a half from the pubes to the base of the sacrum; five inches from one side to the other, and four and a half from one acetabulum to the sacro-iliac junction of the opposite side. The section had been made on the left os pubis, which was cut clean, and without the smallest notch."

From these, and a number of other examples which our limits will not allow us to insert, our author deduces the following conclusions.

"Though the section of the pubes has been thought more simple, more easy, and certain, than the Cæsarean operation, at a time when experience had not yet demonstrated the difficulties it might present, and the dangers that might follow it, ought we to think the same of it at present? How many times already has it been necessary to have recourse to the saw to separate the ossa pubis? and how often has it not been found impossible to procure any distance between them after the separation? How often has this operation produced a free passage for the child, whose preservation ought necessarily to enter into the plan of the operator, as well as that of the mother, and constitute a part of its success?

"This new operation will appear more simple and less painful than the Cæsarean, if we only consider the extent of the incision, and the nature and importance of the parts concerned in it: that is an indisputable fact. It is only the teguments and the fat which is divided, at most only two inches and an half, and the symphysis of the pubes; there are usually only small vessels cut, incapable of furnishing much blood, and the instrument does not touch the uterus; the child comes into the world by the way that nature intended, and which the section of the pubes renders more or less accessible; there is no considerable hæmorrhagy to be feared, nor those extravasations of milky and purulent matter which almost always mortally injure the interior viscera which they fall upon; there are no absolute difficulties in the execution of this operation but what arise from the intimate consolidation of the bones; and it no way exposes women to subsequent hernias which have been so frequently seen after the Cæsarean operation: this is the idea which its partisans have had of it, and which the greater part of them still entertain.

"But the section of the pubes seldom procures the child an easy exit; for hitherto the greater part have died in the passage, or have been victims, a few minutes after their exit, to the efforts necessary to effect it. When the separation of the ossa pubis has been made, it has not always been possible to remove them from each other, on account of the consolidation of the ilia with the sacrum; and this case, which does not seem to be exceedingly rare, and which cannot be known till after the operation, renders it fruitless, and cannot dispense us from the Cæsarean operation.

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"If we reflect ever so little on the danger to which the child is exposed in a preternatural labour, where we are obliged to bring it by the feet, and on the small number that then escape death, when the mother's pelvis has not, pretty nearly all its natural dimensions, we discover another source of accidents which accompanies the section of the pubes; and which we doubtless should diminish, if we could commit the expulsion of the child to the contractions of the uterus, or take hold of the head with the forceps as some practitioners have already done: but except in that very small number of cases, the child has always been extracted by the feet whether the head presented or not.

"Though this operation very seldom secures the child's life, even when the pelvis is not excessively deformed, it is not then always exempt from the severest consequences to the mother. The death of both is certain when that deformity is extreme. The consequences of a spontaneous separation of the ossa pubis, and of the ossa ilia and sacrum, in some natural or labourious labours, long since announced those which might be expected from this new operation; the example of Vespres, these of the fifth woman on whom M. le Roy performed it, the fourth by M. Cambon, that at Arras, at Dusseldorp, at Spire, at Lyons, at Gênes; that by M. Riollay, by M. Matthiis, &c. have proved that it was not without cause that those accidents were dreaded. A devastation in the external parts and the neck of the uterus; an inflammation and gangrene of that viscus; collections of purulent, sanious, and putrid matter, in the cellular tissue of the pelvis; a hernia of the bladder between the ossa pubis; echimoses along the psoæ muscles; injury to the canal of the urethra; incontinence of urine, and gangrenes more or less profound, &c. form the group of accidents of which this new operation is susceptible. Granting that those of the Cæsarean operation are as formidable for the mother, at least it presents a certain resource, exempt from every danger, for the child. Which of the two operations, therefore ought to be preferred?

"Even if we could without inconveniences to the woman obtain a separation of two inches and an half between the ossa pubis after the section of their symphysis, the Cæsarean operation would still be the sole resource in cases of extreme deformity of the pelvis; the section of the pubes cannot enter into comparison with it, except when the small diameter of the superior strait shall have, at least, an extent of two inches and an half. Though I suspended my judgement, at the time I published my first edition, concerning the preference to be given to one of these two methods, in the latter case, till I could procure more positive information of the innocence or danger of so considerable a separation; though I required that men who had no interest in vaunting this new method to the detriment of the former; in one word, that its adversaries should have seen a separation of two inches and an half, without a rupture of the sacro-iliac symphyses, and without inconveniences to make me adopt this new operation; at present, better informed on all these points, I am not afraid to reject it, and to affirm, that no one has ever separated the ossa pubis two inches and a half without destroying the life of the woman. It has had no success but when it has been performed on pelvises at least two inches three quarters in the small diameter, and when the separation has been limited to much less than the point to which they fancied it was carried; in those cases, in fact, where it was absolutely useless; the pelvis being larger still, for I have found it to be more than three inches in some of the women. The section of the pubes cannot at present maintain any comparison with the Cæsarean operation; at most, it might be substituted for the forceps, in some particular cases only: for it cannot, without great inconveniences, give the pelvis an increase of more than two lines from the pubes to the sacrum superiorly; and that instrument may, without danger, reduce the diameter of the child's head as much. But what practitioner would prefer a new operation, which seems to be surrounded by rocks on every side, to one that has been crowned with a thousand successes? If we allow the former any advantages, they would never be more evident than in that species of locked head mentioned by Roederer, where we cannot (says he) introduce any instrument between the head and the pelvis, at whatever part we attempt it; in that case, it would merit a preference over opening the cranium, the use of the crotchets, and the Cæsarean section proposed by the same author: it would be preferable also, in cases where the inferior strait is contracted transversely, provided that a small separation were sufficient to give that diameter the necessary extent."

PART III. OF DISORDERS SUBSEQUENT TO DELIVERY.

CHAP. I. *Of the general Management of Women after delivery*

THE woman being delivered of the child and placenta, let a soft linen-cloth, warmed, be applied to the external parts; and if she complains much of a smarting soreness, some pomatum may be spread upon it. The linen that was laid below her, to spunge up the discharges, must be removed, and replaced with others that are clean, dry, and warm. Let her lie on her back, with her legs extended close to each other; or upon her side, if she thinks she can lie easier in that position, until she recovers from the fatigue: if she is spent and exhausted, let her take a little warm wine or caudle, or, according to the common custom, some nutmeg and sugar grated together in a spoon; the principal design of administering this powder, which among the good women is seldom neglected, is to supply the want of some cordial draught, when the patient is too weak to be raised, or supposed to be in danger of retchings from her stomach's being overloaded. When she hath in some measure recovered her strength and spirits, let the cloths be removed from the parts, and others applied in their room; and, if there is a large discharge from the uterus, let the wet linen below her be also shifted, that she may not run the risk of catching cold.

Management after Delivery.

When the patient is either weak or faintish, she ought not to be taken out of bed or even raised up to have her head and body shifted, until she is a little recruited; otherwise she will be in danger of repeated faintings, attended with convulsions, which sometimes end in death. To prevent these bad consequences, her skirt and petticoats ought to be loosened and pulled down over the legs, and replaced by another well warmed, with a broad head-band to be slipt in below, and brought up over her thighs and hips; a warm double cloth must be laid on the belly, which is to be surrounded by the head-band of the skirt pinned moderately tight over the cloth, in order to compress the viscera and the relaxed parietes of the abdomen, more or less as the woman can easily bear it; by which means the uterus is kept firm in the lower part of the abdomen, and prevented from rolling from side to side when the patient is turned; but the principal end of this compression is to hinder too great a quantity of blood from rushing into the relaxed vessels of the abdominal contents, especially when the uterus is emptied all of a sudden by a quick delivery. The pressure being thus suddenly removed, the head is all at once robbed of its proportion of blood, and the immediate revulsion precipitates the patient into dangerous lypothymia.

For this reason the belly ought to be firmly compressed by the hands of an assistant, until the bandage is applied; or, in lieu of it, a long towel, sheet, or roller, to make a suitable compression; but for this purpose different methods are used in different countries, or according to the different circumstances of the patients. The head-cloths and shift ought also to be changed, because with sweating in time of labour they are rendered wet and disagreeable. Several other applications are necessary, when the external or internal parts are rent or inflamed; misfortunes that sometimes happen in laborious and preternatural cases. We shall conclude this chapter with giving some necessary directions with regard to air, diet, &c.

Although we cannot remove the patient immediately after delivery into another climate, we can qualify the air so as to keep it in a moderate and salutary temper, by rendering it warm or cold, moist or dry, according to the circumstances of the occasion. With regard to diet, women, in time of labour, and even till the ninth day after delivery, ought to eat little solid food, and none at all during the first five or seven: let them drink plentifully of warm diluting fluids such as barley-water, gruel, chicken-water, and teas: caudles are also commonly used, composed of water-gruel boiled up with mace and cinnamon, to which, when strained, is added a third or fourth part of white wine, or less if the patient drinks plentifully, sweetened with sugar to their taste; this composition is termed *white caudle;* whereas, if ale is used instead of wine, it goes under the name of *brown caudle*. In some countries, eggs are added to both kinds; but in that case, the woman is not permitted to eat meat or broths till after the fifth or seventh day; in this country, however, as eggs are no part of the ingredients, the patient is indulged with weak broth sooner, and sometimes allowed to eat a little boiled chicken. But all these different preparations are to be prescribed weaker or stronger, with regard to the spices, wine, or ale, according to the different constitutions and situations of different patients; for example, if she is low and weak, in consequence of an extraordinary discharge of any kind, either before or after delivery, or if the weather is cold, the caudles and broths may be made the stronger, but if she is of a full habit of body and has the least tendency to a fever, or if the season is excessively hot, these drinks ought to be of a very weak consistence, or the patient restricted to gruel, tea, barley and chicken-water, and these varied according to the emergency of the case.

Her food must be light and easy of digestion, such as panada, biscuit, and sago; about the fifth or seventh day she may eat a little boiled chicken, or the lightest kind of young meat; but these last may be given sooner or later according to the circumstances of the case and the appetite of the patient. In the regimen as to the eating and drinking, we should rather err on the abstemious side than indulge the woman with meat and strong fermented liquors, even if these last should be most agreeable to her palate; for we find by experience that they are apt to increase or bring on fevers, and that the most nourishing and salutary diet is that which we have above perscribed. Every thing that is difficult of digestion, or quickens the circulating fluids, must of necessity promote a fever, by which the necessary discharges are obstructed, and the patient's life endangered.

As to the article of sleeping and watching, the patient must be kept as free from noise as possible, by covering the floors and stairs with carpets and cloths, oiling the hinges of the doors, silencing the bells, tying up the knockers, and in noisy streets strowing the pavement with straw; if, notwithstanding these precautions, she is disturbed, her ears must be stuffed with cotton, and opiates administred to procure sleep; because watching makes her restless, prevents perspiration, and promotes a fever.

Motion and rest are another part of the nonnaturals to which we ought to pay particular regard. By tossing about, getting out of bed, or sitting up too long, the perspiration is discouraged and interrupted; and in this last attitude the uterus, not yet fully contracted, hangs down, stretching the ligaments, occasioning pain, cold shiverings, and a fever; for the prevention of these bad symptoms, the patient must be kept quiet in bed till after the fourth or fifth day, and then be gently lifted up in the bed-cloaths, in a lying posture, until the bed can be adjusted, into which she must be immediately reconveyed, there to continue, for the most part, till the ninth day; after which period women are not so subject to fevers as immediately after delivery. Some there are who, from the nature of their constitutions, or other accidents, recover more slowly, and such are to be treated with the same caution after as before the ninth day, as the case seems to indicate; others get up, walk about, and recover, in a much shorter time; but these may some time or other pay dearly for their foolhardiness, by encouraging dangerous fevers; so that we ought rather to err on the safe side than run any risk whatsoever.

What next comes under consideration is the circumstance of retention and excretion. We have formerly observed, that, in time of labour, before the head of the child is locked into the pelvis, if the woman has not had an easy passage in her belly that same day, the rectum and colon ought to be emptied by a glyster

Floodings. glyster, which will assist the labour, prevent the disagreeable excretion of the fæces before the child's head, and enable the patient to remain two or three days after without the necessity of going to stool. However, should this precaution be neglected, and the patient very costive after delivery, we must beware of throwing up stimulating glysters, or administering strong cathartics, lest they should bring on too many loose stools, which, if they cannot be stopt, sometimes produce fatal consequences, by obstructing the perspiration and lochia, and exhausting the woman, so as that she will die all of a sudden; a catastrophe which hath frequently happened from this practice. Wherefore, if it be necessary to empty the intestines, we ought to prescribe nothing but emollient glysters, or some very gentle opener, such as manna, or *elect. lenitivum*. But no excretion is of more consequence to the patient's recovery than a free perspiration; which is so absolutely necessary, that unless she has a moisture continually on the surface of her body for some days after the birth, she seldom recovers to advantage: her health, therefore, in a great measure depends upon her enjoying undisturbed repose, and a constant breathing sweat, which prevents a fever, by carrying off the tension, and assists the equal discharge of the lochia; and when these are obstructed, and a fever ensues with pain and restlessness, nothing relieves the patient so effectually as rest and profuse sweating, procured by opiates and sudorifics at the beginning of the complaints; yet these last must be more cautiously prescribed in excessive hot than in cool weather.

The last of the nonnaturals to be considered are the passions of the mind, which also require particular attention. The patient's imagination must not be disturbed by the news of any extraordinary accident which may have happened to her family or friends: for such information hath been known to carry off the labour-pains entirely, after they were begun, and the woman has sunk under her dejection of spirits; and, even after delivery, these unseasonable communications have produced such anxiety as obstructed all the necessary excretions, and brought on a violent fever and convulsions, that ended in death.

Chap. II. *Of violent Floodings.*

All women, when the placenta separates, and after it is delivered, lose more or less red blood, from the quantity of half a pound to that of one pound, or even two; but should it exceed this proportion, and continue to flow without diminution, the patient is in great danger of her life: This hazardous hemorrhagy is known by the violence of the discharge, wetting fresh cloths as fast as they can be applied; from the pulse becoming low and weak, and the countenance turning pale; then the extremities grow cold, she sinks into faintings, and, if the discharge is not speedily stopped or diminished, is seized with convulsions, which often terminate in death.

This dangerous efflux is occasioned by every thing that hinders the emptied uterus from contracting, such as great weakness and lassitude, in consequence of repeated floodings before delivery; the sudden evacuation of the uterus; sometimes, though seldom, it proceeds from part of the placenta's being left in the womb; it may happen when there is another child, or more, still undelivered; when the womb is kept distruded with a large quantity of coagulated blood; or when it is inverted by pulling too forcibly at the placenta. After-pains

In this case, as there is no time to be lost, and internal medicines cannot act so suddenly as to answer the purpose, we must have immediately recourse to external application. If the disorder be owing to weakness, by which the uterus is disabled from contracting itself, so that the mouths of the vessels are left open; or, though contracted a little, yet not enough to restrain the hemorrhagy of the thin blood; or if, in separating the placenta, the accoucheur has scratched or tore the inner surface or membrane of the womb; in these cases, such things must be used as will assist the contractile power of the uterus, and hinder the blood from flowing so fast into it and the neighbouring vessels: for this purpose, cloths dipped in any cold astringent fluid, such as oxycrate, or red tart wine, may be applied to the back and belly. Some prescribe venesection in the arm, to the amount of five or six ounces, with a view of making revulsion; if the pulse is strong, this may be proper; otherwise, it will do more harm than good. Others order ligatures, for compressing the returning veins at the hams, arms, and neck, to retain as much blood as possible in the extremities and head. Besides these applications, the vagina may be filled with tow or linen-rags, dipped in the abovementioned liquids, in which a little allum or sachar. saturni hath been dissolved; nay some practitioners inject proof-spirits warmed, or, soaking them up in a rag or spunge, introduce and squeeze them into the uterus, in order to constringe the vessels.

If the flooding proceeds from another child, the retention of the placenta, or coagulated blood, these ought immediately to be extracted; and if there is an inversion of the uterus, it must be speedily reduced. Should the hemorrhagy, by these methods, abate a little, but still continue to flow, though not in such a quantity as to bring on sudden death, some red wine and jelly ought to be prescribed for the patient, who should take it frequently, and a little at a time; but above all things chicken or mutton broths, administered in the same manner, for fear of overloading the weakened stomach, and occasioning retching; these repeated in small quantities, will gradually fill the exhausted vessels, and keep up the circulation. If the pulse continues strong, it will be proper to order repeated draughts of barley-water, accidulated with elixir vitriol: but if the circulation be weak and languid, extract of the bark, dissolved in *aq. cinnamomi tenuis*, and given in small draughts, or exhibited in any other form, will be serviceable; at the same time, lulling the patient to rest with opiates. These indeed, when the first violence of the blood is abated, if properly and cautiously used, are generally more effectual than any other medicine.

Chap. III. *Of the After-Pains.*

After-pains commonly happen when the fibrous part of the blood is retained in the uterus or vagina, and formed into large clots, which are detained by the sudden contraction of the os internum and exter-

num,

Lochia. num, after the placenta is delivered: or, if these should be extracted, others will sometimes be formed, though not so large as the first, because the cavity of the womb is continually diminishing after the birth. The uterus, in contracting, presses down these coagula to the os internum; which being again gradually stretched, produces a degree of labour-pains, owing to the irritation of its nerves: in consequence of this uneasiness, the woman squeezes the womb as in real labour; the force being increased, the clots are pushed along, and when they are delivered she grows easy.—The larger the quantity is of the coagulated blood, the severer are the pains, and the longer they continue.

Women in the first child seldom have after-pains; because, after delivery, the womb is supposed to contract and push off the clots with greater force in the first than in the following labours: after-pains may also proceed from obstructions in the vessels, and irritations at the os internum. In order to prevent or remove these pains, as soon as the placenta is separated and delivered, the hand being introduced into the uterus, may clear it of all the coagula. When the womb is felt through the parietes of the abdomen larger than usual, it may be taken for granted that there is either another child, or a large quantity of this clotted blood; and, which soever it may be, there is a necessity for its being extracted. If the placenta comes away of itself, and the after-pains are violent, they may be alleviated and carried off by an opiate: for, by sleeping and sweating plentifully, the irritation is removed, the evacuations are increased, the os uteri is insensibly relaxed, and the coagula slide easily along. When the discharge of the lochia is small, the after-pains, if moderate, ought not be restrained: because the squeezing which they occasion promotes the other evacuation, which is necessary for the recovery of the patient. After-pains may also proceed from an obstruction in some of the vessels, occasioning a small inflammation of the os internum and ligaments; and the squeezing thereby occasioned may not only help to propel the obstructing fluid, but also (if not too violent) contribute to the natural discharges.

Chap. IV. *Of the Lochia.*

We have already observed, that the delivery of the child and placenta is followed by an efflux of more or less blood, discharged from the uterus, which, by the immediate evacuation of the large vessels, is allowed to contract itself the more freely, without the danger of an inflammation, which would probably happen in the contraction, if the great vessels were not emptied at the same time: but as the fluids in the smaller vessels cannot be so soon evacuated, or returned into the vena cava, it is necessary that, after the great discharge is abated, a slow and gradual evacuation should continue, until the womb shall be contracted to near the same size to which it had before pregnancy; and to this it attains about the 18th or 20th day after delivery, though the period is different in different women.

When the large vessels are emptied immediately after delivery, the discharge frequently ceases for several hours, until the fluids in the smaller vessels are propelled into the larger, and then begins to flow again, of a paler colour. Milk fever

The red colour of the lochia commonly continues till the fifth day, though it is always turning more and more serous from the beginning: but, about the fifth day, it flows of a clear, or sometimes (though seldom) of a greenish tint; for, the mouths of the vessels growing gradually narrower by the contraction of the uterus, at last allow the serous part only to pass: as for the greenish hue, it is supposed to proceed from a dissolution of the cellular or cribriform membrane or mucus, that surrounded the surface of the placenta and chorion; part of which, being left in the uterus, becomes livid, decays, and, dissolving, mixes with and tinctures the discharge as it passes along.

Though the lochia, as we have already observed, commonly continue till the 18th or 20th day, they are every day diminishing in quantity, and soonest cease in those women who suckle their children, or have had an extraordinary discharge at first; but the colour, quantity, and duration, differ in different women: in some patients, the red colour disappears on the first or second day; and in others, though rarely, it continues more or less to the end of the month: the evacuation in some is very small, in others excessive: in one woman it ceases very soon, in another flows during the whole month: yet all of these patients shall do well.

Some allege, that this discharge from the uterus is the same with that from a wound of a large surface; but it is more reasonable to suppose, that the change of colour and diminution of quantity proceed from the slow contraction of the vessels; because, previous to pus, there must have been lacerations and imposthumes, and, in women who have suddenly died after delivery, no wound or excoriation hath appeared upon the inner surface of the womb, which is sometimes found altogether smooth, and at other times rough and unequal, on that part to which the placenta adhered. The space that is occupied before the delivery, from being six inches in diameter, or 18 inches in circumference, will, soon after the birth, be contracted to one third or fourth of these dimensions.

Chap. V. *Of the Milk-fever.*

About the fourth day, the breasts generally begin to grow turgid and painful. We have formerly observed, that, during the time of uterine gestation, the breasts in most women gradually increase till the delivery, growing softer as they are enlarged by the vessels being more and more filled with fluids; and by this gradual distension they are prepared for secreting the milk from the blood after delivery. During the two or three first days after parturition, especially when the woman has undergone a large discharge, the breasts have been sometimes observed to subside and grow flaccid; and about the 3d or 4th day, when the lochia begin to decrease, the breasts swell again to their former size, and stretch more and more, until the milk, being secreted, is either sucked by the child, or frequently of itself runs out at the nipples.

Most

Milk-fever

Most of the complaints incident to women after delivery, proceed either from the obstruction of the lochia in the uterus, or of the milk in the breasts, occasioned by any thing that will produce a fever; such as catching cold, long and severe labour, eating food that is hard of digestion, and drinking fluids that quicken the circulation of the blood in the large vessels; by which means the smaller, with all the secretory and excretory ducts, are obstructed.

The discharge of the lochia being so different in women of different constitutions, and besides in some measure depending upon the method of management, and the way of life peculiar to the patient, we are not to judge of her situation from the colour, quantity, and duration of them, but from the other symptoms that attend the discharge; and if the woman seems hearty, and in a fair way of recovery, nothing ought to be done with a view to augment or diminish the evacuation. If the discharge be greater than she can bear, it will be attended with all the symptoms of inanition; but as the lochia seldom flow so violently as to destroy the patient of a sudden, she may be supported by a proper nourishing diet, assisted with cordial and restorative medicines. Let her, for example, use broths, jellies, and asses milk; if the pulse is languid and sunk, she may take repeated doses of the *confect. cardiac.* with mixtures composed of the cordial waters and volatile spirits: subastringents and opiates frequently administered, with the *cort. Peruvian.* in different forms, and austere wines, are of great service. On the other hand, when the discharge is too small, or hath ceased altogether, the symptoms are more dangerous, and require the contrary method of cure: for now the business is to remove a too great plenitude of the vessels in and about the uterus, occasioning tension, pain, and labour, in the circulating fluids; from whence proceed great heat in the part, restlessness, fever, a full, hard, quick pulse, pains in the head and back, nausea, and difficulty in breathing. These complaints, if not at first prevented, or removed by rest and plentiful sweating, must be treated with venesection and the antiphlogistic method.

When the obstruction is recent, let the patient lie quiet, and encourage a plentiful diaphoresis, by drinking frequently of warm, weak, diluting fluids, such as water-gruel, barley-water, tea, or weak chicken-broth.

Should these methods be used without success, and the patient, far from being relieved by rest, plentiful sweating, or a sufficient discharge of the obstructed lochia, labour under an hot dry skin, anxiety, and a quick, hard, and full pulse, the warm diaphoretics must be laid aside; because, if they fail of having the desired effect, they must necessarily increase the fever and obstruction, and recourse be had to bleeding at the arm or ankle to more or less quantity, according to the degree of fever and obstruction; and this evacuation must be repeated as there is occasion. When the obstruction is not total, it is supposed more proper to bleed at the ankle than at the arm; and at this last, when the discharge is altogether stopped, her ordinary drink ought to be impregnated with nitre.

If she is costive, emollient and gently opening glysters may be occasionally injected; and her breasts must be fomented and sucked, either by the mouth or pipe-glasses. If by these means the fever is abated, and the necessary discharges return, the patient commonly recovers; but if the complaints continue, the antiphlogistic method must still be pursued. If, notwithstanding these efforts, the fever is not diminished or removed by a plentiful discharge of the lochia from the uterus, the milk from the breasts, or by a critical evacuation by sweat, urine, or stool, and the woman is every now and then attacked with cold shiverings; an abscess or abscesses will probably be formed in the uterus or neighbouring parts, or in the breasts; and sometimes the matter will be translated to other situations, and the seat of it foretold from the part's being affected with violent pains: these abscesses are more or less dangerous, according to the place in which they happen, the largeness of the suppuration, and the good or bad constitution of the patient.

If, when the pain in the epigastric region is violent, and the fever increased to a very high degree, the patient should all of a sudden enjoy a cessation from pain, without any previous discharge or critical eruption, the physician may pronounce that a mortification is begun; especially if, at the same time, the pulse becomes low, quick, wavering, and intermitting: if the woman's countenance, from being florid, turns dusky and pale, while she herself, and all the attendants, conceive her much mended; in that case, she will grow delirious, and die in a very short time.

What we have said on this subject regards that fever which proceeds from the obstructed lochia, and in which the breasts may likewise be affected: but the milk-fever is that in which the breasts are originally concerned, and which may happen tho' the lochia continue to flow in sufficient quantity; nevertheless, they mutually promote each other, and both are to be treated in the manner already explained: namely, by opiates, diluents, and diaphoretics, in the beginning; and, the prescriptions failing, the obstructions must be resolved by the antiphlogistic method described above. The milk-fever alone, when the uterus is not concerned, is not so dangerous, and is much more easily relieved. Women of an healthy constitution, who suckle their own children, have good nipples, and whose milk comes freely, are seldom or never subject to this disorder, which is more incident to those who do not give suck, and neglect to prevent the secretion in time; or, when the milk is secreted, take no measures for emptying their breasts. This fever likewise happens to women who try too soon to suckle, and continue their efforts too long at one time; by which means the nipples, and consequently the breasts, are often inflamed, swelled, and obstructed.

In order to prevent a too great turgency in the vessels of the breasts, and the secretion of milk, in those women who do not choose to suckle, it will be proper to make external application of those things which, by their pressure and repercussive force, will hinder the blood from flowing in too great a quantity to this part, which is now more yielding than at any other time: for this purpose, let the breasts be covered with *emp. de minia*, *diapalma*, or *emp. simp.* spread upon linen, or cloths dipped in camphorated spirits, be frequently applied to these parts and the arm-pits; while the patient's diet and drink is of the lightest kind, and given

Evacuations.

given in ſmall quantities. Notwithſtanding theſe precautions, a turgency commonly begins about the third day; but by reſt, moderate ſweating, and the uſe of theſe applications, the tenſion and pain will ſubſide about the fifth or ſixth day, eſpecially if the milk runs out at the nipples: but if the woman catches cold, or is of a full habit of body, and not very abſtemious, the tenſion and pain increaſing, will bring on a cold ſhivering ſucceeded by a fever; which may obſtruct the other excretions, as well as thoſe of the breaſt.

In this caſe, the ſudorifics above recommended muſt be preſcribed; and if a plentiful ſweat enſue, the patient will be relieved; at the ſame time the milk muſt be extracted from her breaſts, by ſucking with the mouth or glaſſes: ſhould theſe methods fail, and the fever increaſe, ſhe ought to be blooded in the arm; and inſtead of the external applications hitherto uſed, emollient liniments and cataplaſms muſt be ſubſtituted, in order to ſoften and relax. If, in ſpite of theſe endeavours, the fever proceeds for ſome days, the patient is frequently relieved by critical ſweats, a large diſcharge from the uterus, miliary eruptions, or looſe ſtools mixed with milk, which is curdled in the inteſtines; but ſhould none of theſe evacuations happen, and the inflammation continue with increaſing violence, there is danger of an impoſthume, which is to be brought to maturity, and managed like other inflammatory tumors; and no aſtringents ought to be applied, leſt they ſhould produce ſcirrhous ſwellings in the glands.

As the criſis of this fever, as well as of that laſt deſcribed, often conſiſts in miliary eruptions over the whole ſurface of the body, but particularly on the neck and breaſt, by which the fever is carried off, nothing ought to be given which will either greatly increaſe or diminiſh the circulating force, but ſuch only as will keep out the eruptions. But if, notwithſtanding theſe eruptions, the fever, inſtead of abating, is augmented, it will be neceſſary to diminiſh its force, and prevent its increaſe, by thoſe evacuations we have mentioned above. On the contrary, ſhould the pulſe ſink, the eruptions begin to retreat inwardly, and the morbific matter be in danger of falling upon the viſcera, we muſt endeavour to keep them out by opiates and ſudorific medicines; and here bliſters may be applied with ſucceſs.

Chap. VI. *Of the Evacuations neceſſary at the end of the Month after Delivery.*

Those who have had a ſufficient diſcharge of the lochia, plenty of milk, and ſuckle their own children, commonly recover with eaſe, and, as the ſuperfluous fluids of the body are drained off at the nipples, ſeldom require evacuations at the end of the month; but if there are any complaints from fulneſs, ſuch as pains and ſtitches, after the 20th day, ſome blood ought to be taken from the arm, and the belly gently opened by frequent glyſters, or repeated doſes of laxative medicines.

If the patient has tolerably recovered, the milk having been at firſt ſucked or diſcharged from the nipples, and afterwards diſcuſſed, no evacuations are neceſſary before the third or fourth week; and ſometimes not till after the firſt flowing of the menſes, which commonly happens about the fifth week; if they do not appear within that time, gentle evacuations muſt be preſcribed, to carry off the plethora, and bring down the catamenia.

Explanation of the Plates.

EXPLANATION OF THE PLATES.

Plate CCCXVI. fig. 1. repreſents a well formed pelvis.

AAAA, The *oſſa ilia*, properly ſo called. *a a*, The iliac foſſæ. *b b b b*, The angle which divides tranſverſely and obliquely, from behind forward, the internal face of the os ilium into two parts, making part of the brim of the pelvis. *c c c c*, The criſtæ of the oſſa ilia. *e e*, Their anterior ſuperior ſpines. *f f*, The angle formed by the internal lip of the criſta of the os ilium, to which is attached a ligament inſerted at the other end in the tranſverſe apophyſis of the laſt lumbar vertebra. *g g*, The inferior angle of the os ilium, which makes part of the acetabulum.

BB, The os iſchium. *h h*, Its tuberoſities. *i i*, Its branches. *k k*, Its poſterior part, making part of the acetabulum.

CC, The body of the os pubis. *l l*, Its angle. *m m*, Its poſterior extremity, making part of the acetabulum. *n n*, Its deſcending branch, uniting with that of the iſchium.

DDD, The os ſacrum. 1, 2, 3, 4, The anterior holes. *o o o*, Its baſe. *p p*, The ſides. *q*, The point. E, The coccyx. F, The laſt lumbar vertebra. *r r*, The tranſverſe apophyſis of that vertebra. *s s*, The ligament proceeding from the tranſverſe apophyſis of the laſt vertebra to the angle of the internal lip of the criſta of the os ilium, marked *f f*. *t t*, Another ligament which deſcends from the ſame apophyſis to the ſuperior edge of the ſacro-iliac ſymphyſis.

GG, The femur or thigh-bone. VV, Its head received in the acetabulum. *u, u*, The foramina ovalia.

H, The ſymphyſis of the oſſa pubis. II, The ſacro-iliac ſymphyſes. K, the ſacro-vertebral ſymphyſis.

Fig. 2. repreſents the ſuperior ſtrait of a well formed pelvis.

a a, The iliac foſſæ. *b*, The ſacro-vertebral angle, or projection of the ſacrum. *c*, The laſt lumbar vertebra. *d d*, The lateral parts of the baſe of the ſacrum. *e e*, The ſacro-iliac ſymphyſes. *f f*, The parts over the acetabula. *g*, The ſymphyſis of the pubes.

The lines denote the different diameters of the ſuperior ſtrait. AB, The little diameter. CD, The tranſverſe or great diameter. EF, GH, The oblique diameter, extending from the left acetabulum to the right ſacro-iliac junction.

Fig. 3. ſhows the inferior ſtrait of a well formed pelvis.

a a, The external faces of the oſſa ilia. *b b*, Their anterior ſuperior ſpines. *c c*, Their anterior inferior ſpines. *d d*, The acetabula. *e e*, The foramina ovalia, with the obturator ligaments. *f f*, The iſchiatic tuberoſities. *g g*, The oſſa pubis. *h h*, The branches of the os pubis and iſchium united. *i i*, The ſacrum. *k*, The coccyx. *l l*, The ſacro-iſchiatic ligaments. *m*, The ſymphyſis of the pubes. *n*, Its arch.

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Fig. 1.

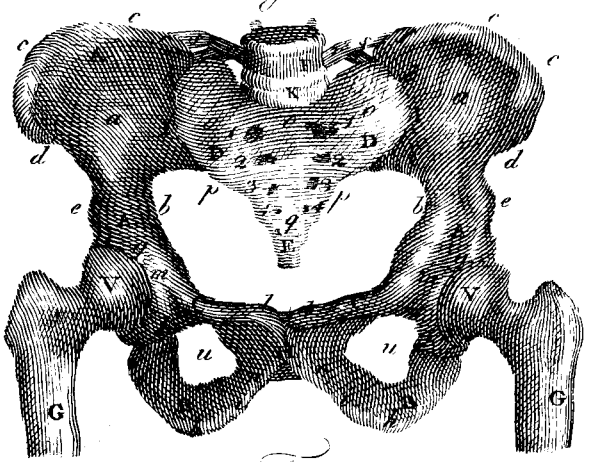


Fig. 4.

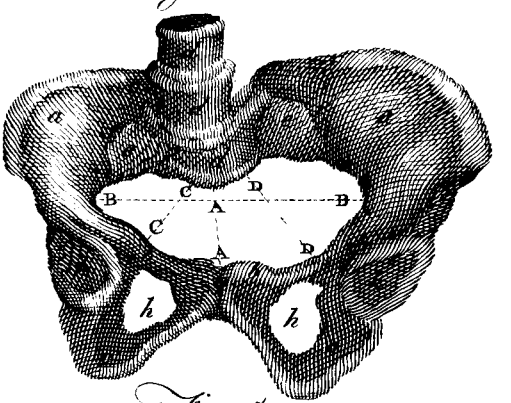


Fig. 2.

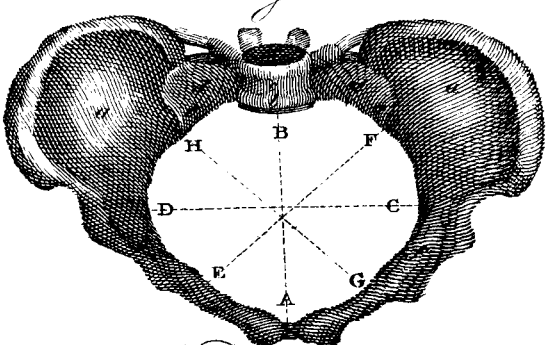


Fig. 5.

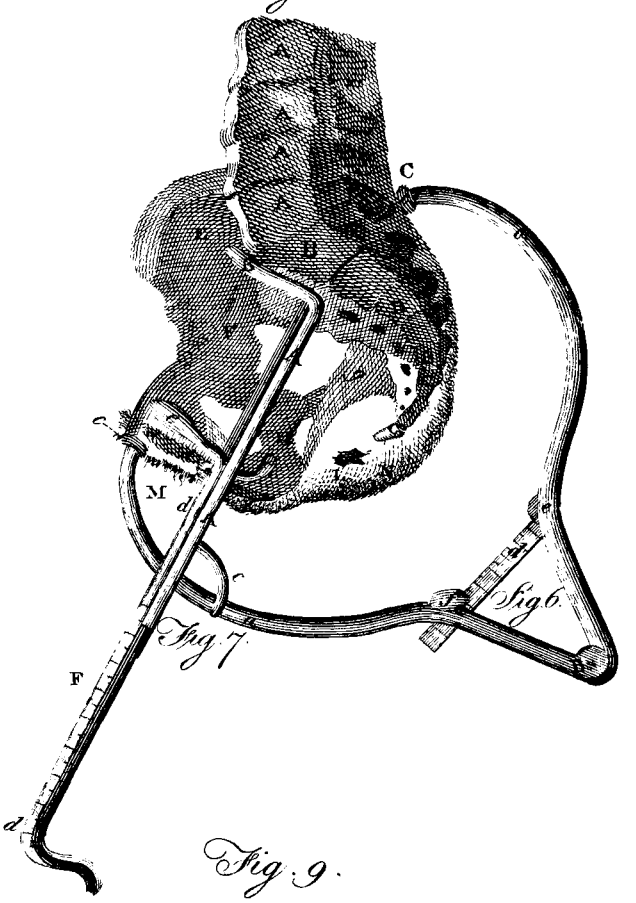


Fig. 3.

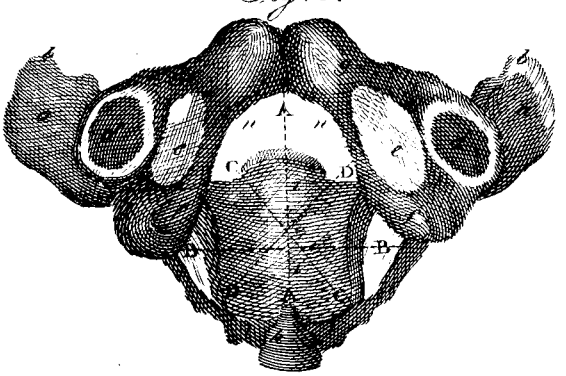


Fig. 6.

Fig. 7.

Fig. 8.

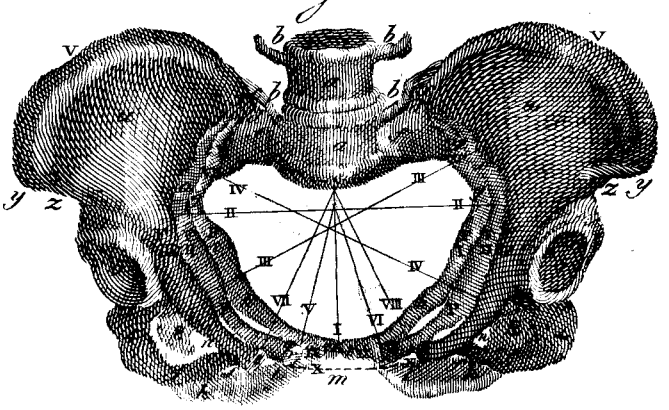
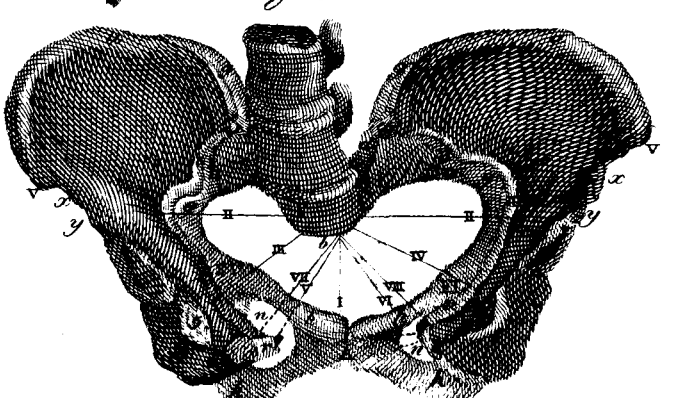


Fig. 9.



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Expanation of the Plates.

The diameters of the inferior ſtrait are marked by the lines. AA, The *antero-poſterior*, or great diameter. BB, The tranſverſe or little diameter. CC, DD, The oblique diameters.

Fig. 4. ſhows a deformed pelvis.

a a, The oſſa ilia. *b b*, The oſſa pubis. *c c*, The oſſa iſchia. *d d d*, The laſt lumbar vertebræ. *e*, The projection of the ſacrum. *f f*, The ſacro iliac ſymphyſes. *g*, The ſymphyſis of the pubes. *h h*, The foramina ovalia. *i i*, The branches of the oſſa pubis and iſchia which form the anterior arch of the pelvis. *k k*, The acetabula.

AA, The *antero-poſterior* diameter; the natural length being 14 or 15 lines. BB, The tranſverſe diameter; the natural length four inches and ten lines. CC, The diſtance from the projection of the ſacrum to that point of the margin which anſwers to the left acetabulum, being 13 lines. DD, The diſtance from the ſame point of the ſacrum to that of the margin which anſwers to the right acetabulum, 20 lines.

Fig. 5. ſhows a vertical ſection of the pelvis.

A, A, A, A, The four laſt lumbar vertebræ. B, B, B, The os ſacrum. CC, The coccyx. *d d*, The ſurface reſulting from the ſection of the ſymphyſis of the pubes. E, The left iliac foſſa. F, The left ſide of the ſuperior ſtrait. G, The ſacro-iſchiatic ligament. H, The tuberoſity of the iſchium.

i i, The entrance of the vagina. K, one of the labia pudendi. L, The anus. M, The Mons veneris. N, The left natis.

Plate CCCVII.

Fig. 10. gives a front-view of the uterus *in ſitu*, ſuſpended in the vagina; the anterior parts of the oſſa iſchium, with the oſſa pubis, pudenda, perinæum, and anus, being removed, in order to ſhow the internal parts.

A, the laſt vertebra of the loins. BB, the oſſa ilium. CC, the acetabula. DD, the inferior and poſterior part of the oſſa iſchium. E, the part covering the extremity of the coccyx. F, the inferior part of the rectum. GG, the vagina cut open longitudinally, and ſtretched on each ſide of the collum uteri, to ſhow in what manner the uterus is ſuſpended in the ſame.

HH, part of the veſica urinaria ſtretched on each ſide of the vagina, and inferior part of the fundus uteri.

I, the collum uteri. K, the fundus uteri. LL, the tubi Fallopiani and fimbriæ. MM, the ovaria. NN, the ligamenta lata and rotunda. OO, the ſuperior part of the rectum.

Fig. 11. gives a front view of the uterus in the beginning of the firſt month of pregnancy; the anterior part being removed that the embryo might appear though the amnios, the chorion being diſſected off.

A, the fundus uteri. B, the collum uteri, with as view of the rugous canal that leads to the cavity of the fundus. C, the os uteri.

Fig. 12. In the ſame view and ſection of the parts as in fig 10. ſhows the uterus as it appears in the ſecond or third month of pregnancy.

F, the anus. G, the vagina, with its plicæ.

HH, the poſterior and inferior part of the urinary bladder extended on each ſide; the anterior and ſuperior part being removed.

II, the mouth and neck of the womb, as raiſed up when examining the ſame by the touch, with one of the fingers in the vagina.

Explanation of the Plates.

KK, the uterus as ſtretched in the ſecond or third month, containing the embryo, with the placenta adhering to the fundus.

Fig. 13. In the ſame view and ſection of the parts with the former figures, repreſents the uterus in the eighth or ninth month of pregnancy.

A, the uterus as ſtretched to near its full extent, with the waters, and containing the fœtus entangled in the funis, the head preſenting at the upper part of the pelvis.

BB, the ſuperior part of the oſſa ilium. CC, the acetabula. DD, the remaining poſterior parts of the oſſa iſchium. E, the coccyx. F, the inferior part of the rectum. GGG, the vagina ſtretched on each ſide. H, the os uteri the neck being ſtretched to its full extent or entirely obliterated. II. part of the veſica urinaria. KK, the placenta, at the ſuperior and poſterior part of the uterus. LL, the membranes. M, the funis umbilicalis.

Fig. 14. gives a front view of twins *in utero* in the beginning of labour.

A, the uterus as ſtretched, with the membranes and waters. BB, the ſuperior parts of the oſſa ilium. CC, the acetabula. DD, the oſſa iſchium. E, the coccyx. F, the lower part of the rectum. GG, the vagina.

H, the os internum ſtretched open about a finger-breadth, with the membranes and waters, in time of labour pains.

II, the inferior part of the uterus, ſtretched with the waters which are below the head of the child that preſents.

KK, the two placentas adhering to the poſterior part of the uterus, the two fœtuſes lying before them, one with its head in a proper poſition at the inferior part of the uterus, and the other ſituated preternaturally with the head to the fundus; the bodies of each are here entangled in their proper funis, which frequently happens in the natural as well as preternatural poſitions.

LLL, the membranes belonging to each placenta.

Fig. 15. ſhows, in a lateral view and longitudinal diviſion of the parts, the gravid uterus when labour is ſomewhat advanced.

A, the loweſt vertebra of the back, the diſtance from which to the laſt mentioned vertebra is here ſhown by dotted lines. CC, the uſual thickneſs and figure of the uterus when extended by the waters, at the latter end of pregnancy. D, the ſame contracted and grown thicker after the waters are evacuated. EE, the figure of the uterus when pendulous. EF, the figure of the uterus when ſtretched higher than uſual which generally occaſions vomitings and difficulty of breathing. G, the os pubis of the left ſide. HH, the os internum. I, the vagina. K, the left nympha. L, the labium pudendi of the ſame ſide. M, the remaining portion of the bladder. N, the anus. OP, the left hip and thigh.

Fig. 16. ſhows the forehead of the fœtus turned backwards to the os ſacrum, and the occiput below the pubes, by which means the narrow part of the head is to the narrow part of the pelvis, that is, between the inferior parts of the oſſa iſchium.

Explanation of the Plates.

A, the uterus contracted closely to the fœtus after the waters are evacuated. BCD, the vertrebræ of the loins, os sacrum and coccyx. E, the anus. F, the left hip. G, the perinæum. H, the os externum beginning to dilate. I, the os pubis of the left side. K, the remaining portion of the bladder. L, the posterior part of the os uteri.

Plate CCCVIII.

Fig. 17. is principally intended to show in what manner the perinæum and external parts are stretched by the head of the fœtus, in a first pregnancy, towards the end of the labour.

A, the abdomen. B, the labia pudendi. C, the clitoris and its preputium. D, the hairy scalp of the fœtus, swelled at the vertex, in a laborious case, and protruded to the os externum. E, F, the perinæum and anus pushed out by the head of the fœtus in form of a large tumor. GG, the parts that cover the tuberosities of the ossa ischium. H, the part that covers the os coccygis.

Fig. 18. shows in what manner the head of the fœtus is helped along with the forceps, as artificial hands, when it is necessary for the safety of either mother or child.

AABC, the vertebræ of the loins, os sacrum, and coccyx. D, the os pubis of the left side. E, the remaining part of the bladder. FF, the intestinum rectum. GGG, the uterus. H, the mons veneris. I, the clitoris, with the left nymph. X, the corpus cavernosum clitoridis. V, the meatus urinarius. K, the left labium pudendi. L, the anus. N, the perinæum. QP, the left hip and thigh. R, the skin and muscular parts of the loins.

Fig. 19. shows the head of the fœtus, by strong labour-pains squeezed into a longish form, with a tumor on the vertex, from a long compression of the head in the pelvis.

K, the tumor on the vertex. L, the forceps. M, the vesica urinaria much distended with a large quantity of urine from the long pressure of the head against the urethra. N, the under part of the uterus. OO, the os uteri.

Fig. 20. shows in the lateral view, the face of the child presenting and forced down into the lower part of the pelvis, the chin being below the pubes, and the vertex in the concavity of the os sacrum: the water being likewise all discharged, the uterus appears closely joined to the body of the child.

Fig. 21. shows, in a lateral view, the head of the child in the same position as in the former figure.

AB, the vertebræ of the loins, os sacrum, and coccyx. C, the os pubis of the left side. D, the inferior part of the rectum. E, the perinæum. F, the left labium pudendi. GGG, the uterus.

Fig. 22. gives a lateral internal view of a distorted pelvis, divided longitudinally, with the head of a fœtus of the seventh month passing the same.

ABC, the os sacrum and coccyx. D, the os pubis of the left side. E, the tuberosity of the os ischium of the same side.

Fig. 23. gives a side view of a distorted pelvis, divided longitudinally, with the head of a full grown fœtus squeezed into the brim, the parietal bones decussating each other, and compressed into a conical form.

ABC, the os sacrum and coccyx. D, the os pubis of the left side. E, the tuberosity of the os ischium. F, the processus acutus. G, the foramen magnum.

Explanation of the Plates.

Plate CCCIX.

Fig. 24. shows, in a front view of the pelvis, the breech of the fœtus presenting, and dilating the os internum, the membranes being too soon broke.

Fig. 25. is the reverse of the former, the fore-parts of the child being to the fore part of the uterus.

Fig. 26. represents, in a front view of the pelvis, the fœtus compressed, by the contraction of the uterus, into a round form, the fore-parts of the former being towards the inferior parts of the latter, and one foot and hand fallen down into the vagina. In this figure, the anterior part of the pelvis is removed, by a longitudinal section through the middle of the foramen magnum.

AA, the superior parts of the ossa ilium. BB, the uterus. C, the mouth of the womb stretched and appearing in OOOO, the vagina. D, the inferior and posterior part of the os externum. EEEE, the remaining part of the ossa pubis and ischium. FFFF, the membrana adiposa.

Fig. 26. represents, in the same view with fig, 27. the fœtus in the contrary position; the breech and fore-parts being towards the fundus uteris, the left arm in the vagina, and the fore-arm without the os externum, the shoulder being likewise forced into the os uteri.

Plate CCCVI. fig. 8. shows a deformed pelvis of which the small diameter of the superior strait is only 2 inches seven lines. The figure is triple: F. I. shows it in its natural state; F. II. the ossa pubis separated 18 lines; and F. III. with a separation of two inches and an half, in order to show the quantity of amplification which the section of the symphysis in such a pelvis can produce.

F. I. *a a*, the two last lumbar vertebræ; *b b b b*, the transverse apophyses of these vertebræ; *cc*, ligaments proceeding from the transverse apophyses of the last of these vertebræ to the middle and posterior part of the internal lip of the crista of the os ilium; *d d*, other ligaments descending from the same apophyses to the superior part of the sacro-iliac symphyses; *e*, the projection of the sacrum; *f f*, the lateral parts of the base of the sacrum; *g g*, part of the ossa ilia: the rest of those bones being concealed by F. II. and III.

h h, The bodies of the ossa pubis; *i i*, their angles.

k k, The ossa ischia; *l l*, the branches of these bones and of the pubes.

m, The arch of the ossa pubis at the fore part of the pelvis.

n n, The foramina ovalia concealed by the ossa pubis of F. II. and III.

A, The symphysis of the ossa pubis seen perspectively. BB, the sacro-iliac symphyses.

E. II. *o o*, Part of the ossa ilia.

PP, The bodies of the pubis; *q q*, their angles; *r r*, their articular facettes seen perspectively; *f f*, very small portions of the branches of the ossa pubis.

s, s, The ossa ischia appearing behind the foramina ovalia of n° III; *t t*, articular facettes of the ossa ilia, corresponding to similar ones observed at the sides of the sacrum.

F. III. *u u*, The ossa ilia, *vv*, their cristæ; *xx*, the angle formed by the internal lip of the crista in the middle and posterior part of its length; *y y*, the anterior and superior

Fig. 10.

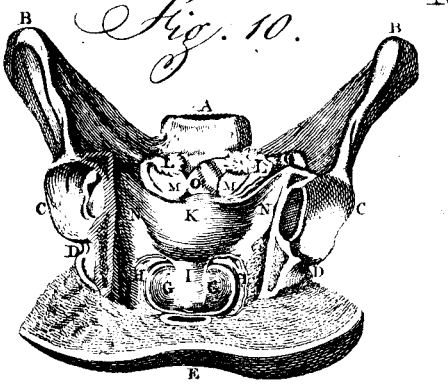


Fig. 11.

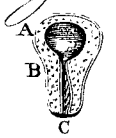
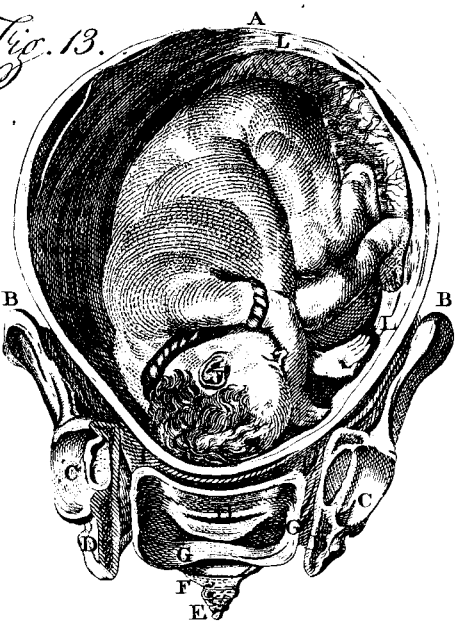


Fig. 13.



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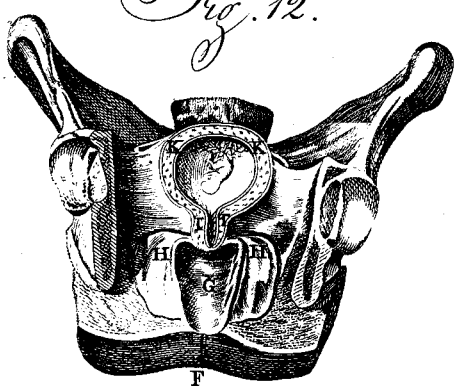

Fig. 14.

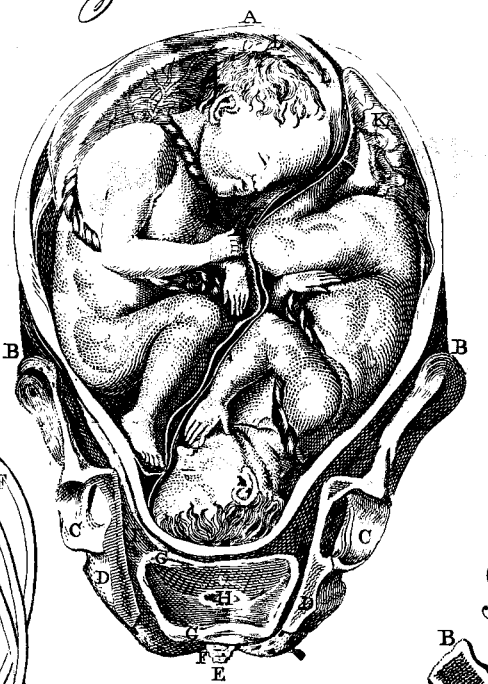

Fig. 15.

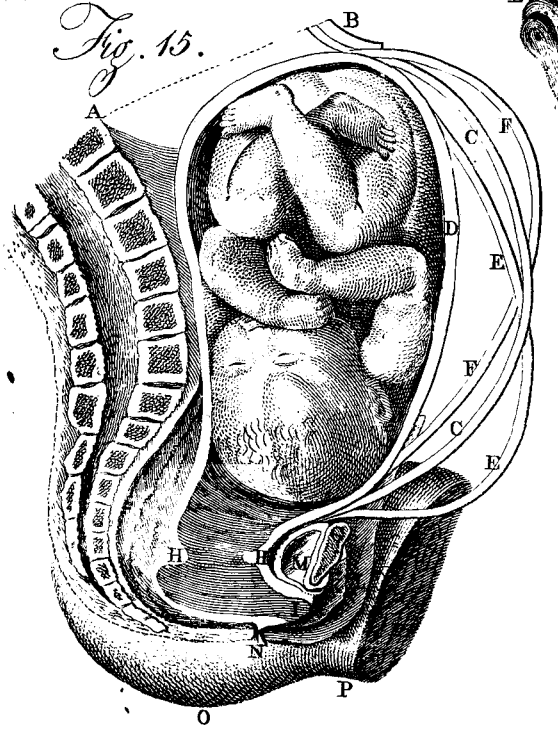

Fig. 16.

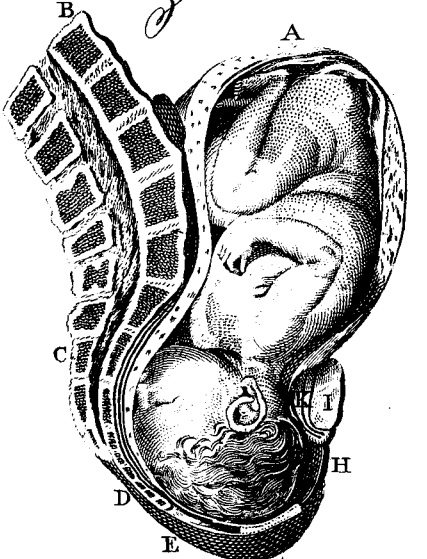

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Fig. 17.

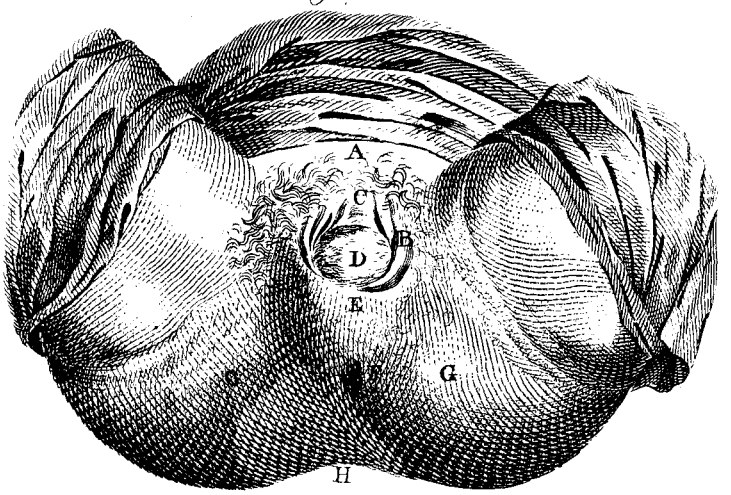


Fig. 18.

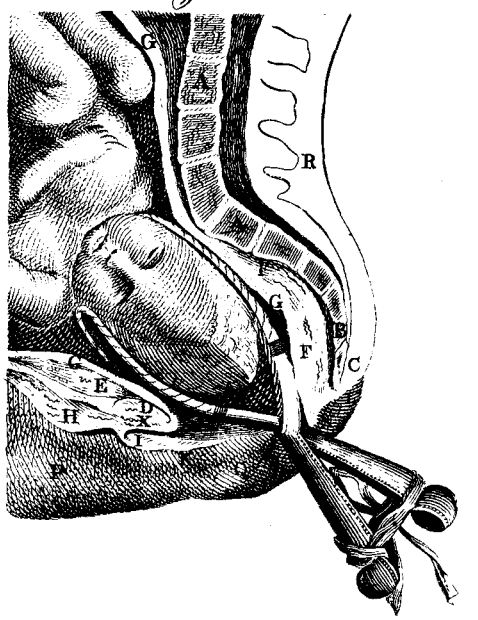


Fig. 19.

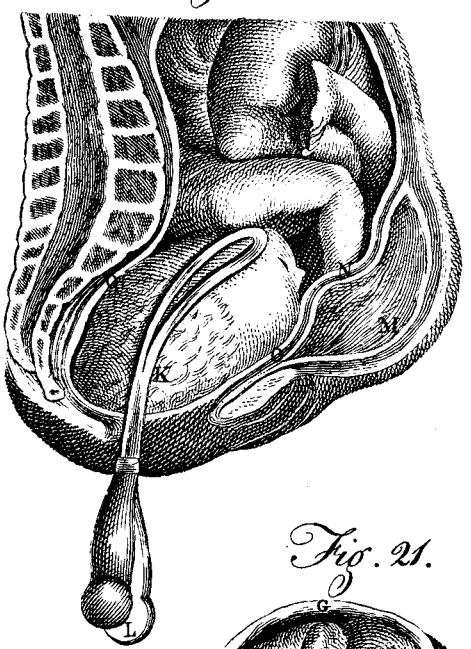


Fig. 20.

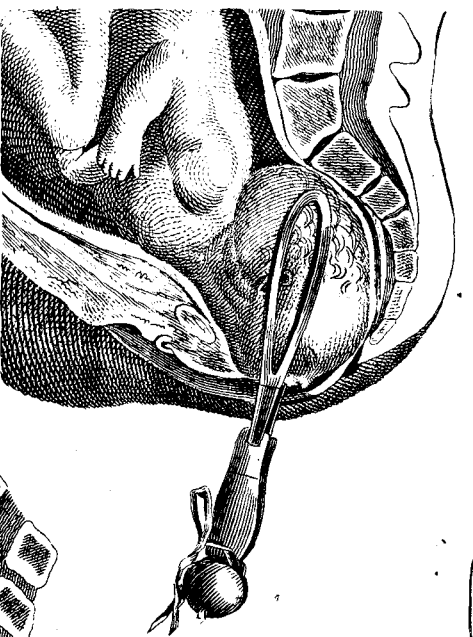


Fig. 22.

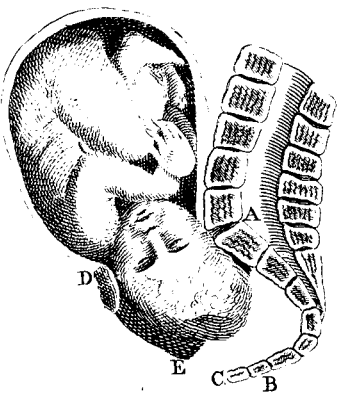


Fig. 21.

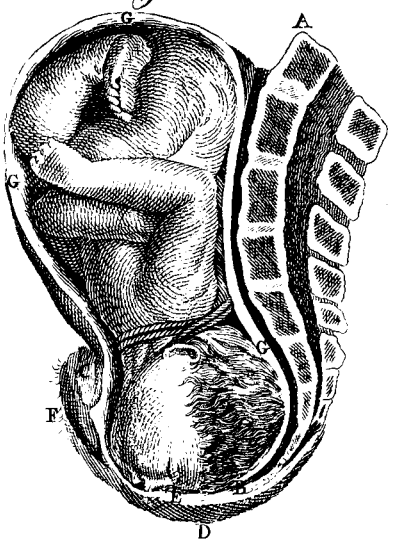
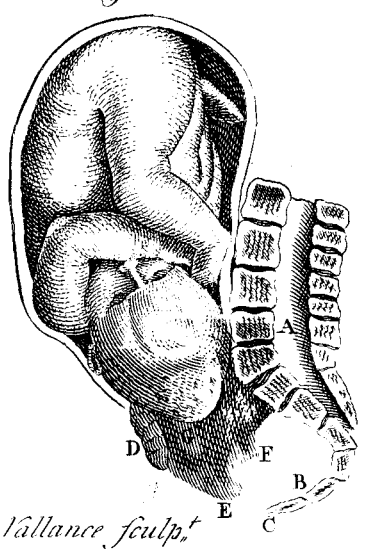


Fig. 23.



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Explanation of the Plates.

superior spines of the ossa ilia; z z, the anterior spines of these bones; & &, articular facettes of the ossa ilia, making part of the sacro-iliac symphyses.

1 1, The ossa pubis; 2 2, their angles; 3 3, their articular facettes seen perspectively.

4 4, The ossa ischia; 5 5, the united branches of the ossa ischia and pubis; 6 6, the acetabula.

The lines indicate the natural size of the pelvis in the different directions in which they are traced; and their dotted extremities, the amplification which the superior strait acquires in those same directions at a separation of eighteen lines, and of thirty lines between the ossa pubis. Line I. Antero-posterior diameter of the superior strait, or the distance from the pubes to the projection of the sacrum; two inches seven lines. Line II. Transverse diameter of the superior strait, in its most extensive part; four inches seven lines. Line III. Oblique diameter of the superior strait, which extends from that point of the strait which corresponds with the anterior edge of the left acetabulum, to the right sacro-iliac junction; three inches eleven lines. Line IV. The other oblique diameter, which extends from that point of the strait which answers to the anterior edge of the right acetabulum, to the left sacro-iliac symphysis; four inches.

By giving the smallest attention to the relation of these dimensions to those which the head of a fœtus of the usual size presents in their direction in time of labour, we shall see that they are very favourable; except the first, which is, strictly speaking, eleven lines too short, being only thirty-one lines in extent: whereas the transverse diameter of the head is commonly forty-two. It is only in this latter direction, and to the extent of eleven lines, that it would be necessary to augment the capacity of such a pelvis, to favour delivery. As the greater part of those who have performed this new operation, have only obtained a separation of eighteen lines or thereabouts between the ossa pubis, it is fixed at that degree in the second figure.

By such a separation in a pelvis perfectly similar to that here represented, the angle of each os pubis recedes from the centre of the projection of the sacrum three lines or very near beyond their natural distance from it. (See the lines V. and VI). The antero-posterior diameter receives but the same increase, if we consider it as lengthened to the middle of the dotted line IX. IX. which marks the depth at which it may be presumed the lateral convexity of the head engages. Both the oblique diameters augment five lines before; and about two lines and an half backward; and the transverse diameter seven lines or very nearly.

It is evident that a separation of eighteen lines on such a pelvis cannot remove the disproportion which exists between the small diameter of the superior strait and the small diameter of the child's head; since the former augments only three lines, considered in the most favourable point of view. The amplification which the other diameters receive from a similar separation, is absolutely useless; those diameters being naturally large enough.

Supposing that the ossa pubis recede in an equal degree, in separating two inches and an half, the angle of each of them will remove from the centre of the projection of the sacrum, only six lines further than the distance they were from it before; which also gives an increase of but six lines between these two points. (See the lines VII. and VIII). The small diameter of the entrance of the pelvis does not gain much more, considering it to the middle of the dotted line XX. which marks the bounds beyond which the convexity of the head could not engage between the ossa pubis, even if the pelvis were divested of all its soft parts: which does not happen in the section of the pubes, for the neck of the bladder, the canal of the urethra, their cellular tissue, the anterior semicircle of the orifice of the uterus, and the anterior part of the vagina present at the opening and before the child's head. At this degree of separation, the transverse diameter augments about thirteen lines, and each oblique diameter nearly fourteen lines: a superfluous increase, since those diameters, in the pelvis represented, have all the length requisite for delivery.

The posterior extremities of the oblique diameters, which are dotted and marked with the figures XI and XII, show the separation which is to be feared in the sacro-iliac symphyses, by separating the ossa pubis two inches and an half. It was at that degree that Mr Baudelocque observed they were open in most of his experiments; since he could easily put the end of his finger, and even of his thumb, into them.

Admitting that the convexity of one of the sides of the child's head may let itself in between the ossa pubis separated to two inches and an half, as far as the dotted line X X, traced on that very convexity, it is evident that that separation cannot procure the relation of dimensions necessary for an easy delivery, when the pelvis has originally but two inches six or seven lines in the small diameter; whence it follows that the section of the pubes, supposing that we could obtain a separation of two inches and an half in the living woman without exposing her to disagreeable accidents, would not answer in the case of a pelvis similar to that represented in this plate.

Fig. 9. shows a pelvis with only 14 or 15 lines in the small diameter of its entrance, and four inches ten lines in the largest. The figure is triple like the former. F. I. represents it in its natural situation; F. II. with the ossa pubis separated two inches and a half; and F. III. with a separation of three inches. M. le Roy says, that he constantly obtained these two degrees of separation without any inconvenience.

F. I. *aaa*, The three last lumbar vertebræ. *b*, The projection formed by the last of those vertebræ, with the base of the sacrum. *cc*, The sides of the base of the sacrum. *ddd*, The transverse apophyses of the right side of the abovementioned vertebræ. *ee*, A ligament extending from the first of those apophyses to the angle made by the internal lip of the crista of the os ilium towards its middle and posterior part. *ff*, Another ligament which depends from that apophysis to the superior part of the sacro-iliac symphysis. *gggg*, Part of the os ilium. *h h*, The bodies of the ossa pubis: *i i*, their angles. *k k*, The ossa ischia. *l l*, The branches of the ossa ischia and pubis. *m*, The arch of the ossa pubis. *n n*, The foramina ovalia. A, the symphysis of the ossa pubis. BB, The sacro-iliac symphyses.

Explanation of the Plates.

F. II. *o o o o*, Part of the offa ilia. *ſſ*, The articular facettes of the offa ilia, making part of the facro-iliac fymphyfes. *p p*, The bodies of the offa pubis. *q q*, The angles of the offa pubis feparated two inches and an half. *r r*, The cartilaginous facettes of the offa pubis feen perfpectively. *s s*, The branches of the offa ifchia and pubes.

F. III. *t t*, The offa ilia: *u u*, their criftæ: *v v*, their anterior fuperior fpines: *x x*, their anterior inferior fpines.

y y, The anterior inferior fpines of the offa ilia of F. II. *z z*, Their anterior articular facettes, making part of the facro-iliac fymphyfis.

& &, The bodies of the offa pubis: 1 1, there angles. 2 2, The articular facette of each os pubis feen perfpectively. 3 3, The united branches of the offa pubis, and ifchia feen perfpectively.

4 4, The offa ifchia. 5 5, The foramina ovalia behind which is feen part of the offa ifchia of F. II. 6 6, The acetabula.

The lines indicate the length of the different diameters of the fuperior ftrait, in the direction in which they are traced; and their dotted extremities, the amplification to be expected from a feparation of two inches and an half, and of three inches.

Line I, The antero-pofterior, or fmall diameter of the fuperior ftrait; one inch two or three lines. Line II, The tranfverfe diameter of the fame ftrait: this line, which is four inches ten lines in extent, paffes under the projection of the facrum. Line III, The diftance from the middle and left lateral part of the projection of the facrum, to that point of the margin of the pelvis which anfwers to the anterior edge of the acetabulum on the fame fide; one inch. Line IV, The diftance from the middle and right lateral part of the projection of the facrum, to that point of the margin which anfwers to the anterior edge of the acetabulum on the fame fide; one inch eight lines.

The relation of thefe dimenfions to thofe of a child's head of the ufual fize, is fuch, that the fmall diameter of the latter, fuppofed always to be three inches and an half, furpaffes the fmall diameter of the entrance of fuch a pelvis by 27 or 28 lines. This pelvis would be large enough in the direction of the line II, II.

By feparating the offa pubis two inches and an half, we augment the breadth of the entrance of the pelvis about three quarters of an inch in the direction of the line II, II: as much, or nearly in the direction of the line III, and only fix lines in that of the line IV. The angle of each os pubis marked by the letter *q*, recedes from the centre of the projection of the facrum, nine or ten lines beyond what it was diftant from it before the feparation of the bones: the entrance of the pelvis increafes as much in the direction of the line V, and only half an inch in the courfe of the line VI. The fmall diameter, or the line I, continued to the middle of the dotted line IX, IX, which fhows the depth to which the child's head may be let in between the offa pubis feparated two inches and an half, if the pelvis were diveſted of all its foft parts: this diameter will then be augmented only feven lines; whence we fee that it would ſtill be an inch and an half, at leaft, fhorter than the fmall diameter of the head of a child of the ufual fize.

The fection of the pubes would therefore be fruitlefs on fuch a pelvis, if it could only procure a feparation of two inches and an half; which feems a very exorbitant one. With more reafon would it be unfuccefsful, if we could feparate the offa pubis only 18 lines, as has moft frequently happened; fince it could not procure the proportion neceffary for delivery, even if we could turn that feparation entirely to the advantage of the fmall diameter of the fuperior ftrait.

Let us fee if a feparation of three inches could procure that proportion.

By feparating the offa pubis three inches, we augment the breadth of the pelvis 12 or 13 lines in the direction of the line II, II; 10 lines at moft in the courfe of the line III; only feven in the line IV; about an inch in the line V; and only feven lines in the direction of the line VI: the angle of each os pubis recedes an inch farther from the projection of the facrum, than the diftance it was at before the feparation of the bones; which augments the opening of the pelvis to the amount of an inch or thereabouts in the direction of the line VII, and only half an inch in the line VIII. The antero-pofterior diameter of the entrance of this pelvis, confidered as far as the middle of the dotted line X X, which fhows the greateft depth to which the child's head could be let in between the offa pubis feparated three inches, if the pelvis were diveſted of the foft parts, increafes but 10 lines or thereabouts: which cannot remove the difproportion that exifted before the fection of the pubes, between that diameter and the thickneſs of the child's head which muft pafs in that direction. From whence we ought to conclude that this feparation alfo would have no fuccefs, if the pelvis were as much deformed as that defigned.

The dotted lines XI and XII, fhow the feparation to be feared in the facro-iliac fymphyfes, by feparating the offa pubis three inches.

The two other dotted lines, marked by the characters IX, IX, and X, X, fhow how far the child's head may be let in between the offa pubis feparated to the two degrees ftated: they were traced on the convexity of a real head applied behind the offa pubis in a pelvis ftripped of its foft parts.

Plate CCCX. fig. 29. fhows a well formed pelvis, the anterior part of which is taken away, to fhow one of the tranfverfe pofitions of the face of the child, and explain more fully the mechanifm of that kind of labour.

a, a, Part of the iliac foffæ. *b, b*, Part of the criftæ of the offa ilia. *c, c*, Their anterior fuperior fpines.

d, d, The ifchiatic tuberofities. *e, e*, The acetabula. *f, f*, the thickneſs of the offa ifchia fawn through vertically before their tuberofities.

g, g, The bodies of the offa pubis fawn through before the acetabula.

h, h, h, A circle repreſenting a vertical fection of the uterus, the anterior part of which is taken away in order to fhow the child. *i*, The child's chin. *k*, The pofterior extremity of the head. *l, l, l*, The lever applied along the crown of the head, the extremity of it extending beyond the pofterior fontanella.

m, The

Explanation of the Plates.

m, The left lateral, and inferior part of the pelvis. *n*, A portion of the right lateral part of the uterine cavity. *p*, The left hand. *p*, *q*, The fore and middle fingers, placed at the sides of the nose, and pressing against the upper jaw. R, The right hand grasping the extremity of the lever.

Plate CCCX.

Fig. 30. shows the same vertical section of a pelvis as the last; with the child's body entirely disengaged from it. The head grasped by the forceps is retained at the superior strait, with the occiput over the pubes, and the lower part of the fore-head against the projection of the sacrum.

a, *a*, The last lumbar vertebræ. *d*, *d*, The canal of these vertebræ, and of the sacrum. *g*, *g*, *g*, *g*, Spiny tubercles of the vertebræ abovementioned. *b*, *b*, *b*, *b*, The false vertebræ of the sacrum. *c*, *c*, *c*, The coccyx. *e*, *e*, The flatted portion of the anterior face of the sacrum.

f, The left sacro-ischiatic ligament. *h*, The cartilaginous and ligamentous facette of the left os pubis making part of the symphysis.

i, The mons veneris. *k*, *k*, *k*, *k*, A circle representing the section of the uterus, the right side of which is taken away to show the head and the instrument. *l*, *l*, A portion of the placenta attached to the superior and anterior part of the uterus.

m, *m*, *m*, The female branch of the forceps applied on the left side of the head, which answers to the right side of the pelvis. *n*, *n*, The male branch of the forceps, applied at the left side of the pelvis, and the right side of the head. *o*, Part of the left small sacro-ischiatic ligament. P, Part of the left os ilium, the rest being concealed by the head.

q, The point to which we ought to bring the lower extremity of the forceps, in bringing the head down into the cavity of the pelvis.

R, the point of elevation at which the extremity of the forceps must be held, when the head occupies the bottom of the pelvis, after having replaced the face underneath.

Fig. 31. shows also the vertical section of a pelvis; but it is supposed to have only three inches six lines in the small diameter of its entrance. The base of the cranium is engaged in it in a transverse direction, the occiput being turned towards the left side, and the face to the right side; so that the greatest thickness of the head is still above the strait.

a, *a*, The two last lumbar vertebræ. *b*, *b*, *b*, *b*, *b*, The five false vertebræ of the sacrum. *c*, *c*, *c*, The three pieces of the coccyx. *d*, *d*, The canal of the aforesaid vertebræ. *e*, *e*, *e*, *e*, Their spinous apophyses. *f*, *f*, Part of the anterior face of the sacrum.

g, The left sacro-ischiatic ligament. *h*, The cartilaginous and ligamentous facette of the left os pubis, making part of the symphysis. *i*, The mons veneris.

k, *k*, *k*, *k*, A circle indicating the section of the uterus in the same direction as that of the pelvis. *l*, *l*, A portion of the placenta attached to the fundus of the uterus.

m, *m*, *m*, The female branch of the forceps, applied on the left side of the child's head, and under the symphysis of the pubes. *n*, *n*, *n*, The female branch of the forceps applied on the right side of the head, and before the sacrum. *o*, A dotted line, in the direction of which the instrument must be pulled to bring down the head into the pelvis. *p*, The point of elevation at which the forceps must be held when the head is brought down to the bottom of the pelvis, after having turned the face into the curve of the os sacrum.

Plate CCCVI. fig. 6. shows M. Baudelocque's calipers for measuring the antero-posterior diameter of the superior strait.

a, *a*, The branches of the calipers. B, The hinge which unites the two branches. *c*, *c*, Lenticular buttons which terminate the branches. *d*, A graduated scale nine inches long, intended to demonstrate the thickness of the body comprised between the two branches. This scale is contained in a deep groove cut lengthwise in the branch of the calipers, from the letter *c*, to the hinge B; and passes through a mortoise made in the other branch under the letter *f*. *e*, The place where the scale is united by a kind of a hinge. *f*, A little screw with a flat head, designed to fix the scale, while we calculate the thickness of the body comprised between the two branches.

Fig. 7. shows the pelvimeter of M. Coutonli developed in the pelvis.

A, A, The first branch; whose square, B, is applied to the projection of the sacrum. C, *c*, A kind of hooks intended to keep the first branch in its place, while we introduce and develope the second. This has a dove-tailed groove, in which the body of the second branch is lodged and moved. *d*, *d*, the second branch of the instrument, whose square *e* is placed against the symphysis of the pubes. F, a scale four inches long, graduated in the branch *d*, *d*; and intended to show the degree of opening from the pubes to the sacrum.

Plate CCCVIII. fig. 21. represents in a lateral view of the pelvis, the method of extracting, by means of a curved crotchet, the head of the fœtus, when left in the uterus, after the body is delivered and separated from it; either by its being too large, or the pelvis too narrow.

ABC, the os sacrum and coccyx.

D, the os pubis of the left side.

EE, the uterus.

F, the locking part of the crotchet.

g, *h*, *i*, The point of the crotchet on the inside of the cranium.

Plate CCCIX.

Fig. 32. represents the forceps and blunt hook.

A, the straight forceps, in the exact proportion as to the width between the blades, and length from the points to the locking part; the first being two and the second six inches, which, with three inches and a half (the length of the handles), make in all 11 inches and a half.

B represents the posterior part of a single blade, in order to show the width and length of the open part of the same, and the form and dimensions of the whole.

C, the blunt hook, which is used for three purposes: 1. To assist the extraction of the head, after the cranium is opened with the scissars, by introducing the small end along the ear on the outside of the head to above the under-jaw, where the point is to be fixed; the other extremity of the hook being held with one hand, whilst two fingers of the other are to be introduced into the foresaid opening, by which hold the head is to be gradually extracted. 2. The small end is

Explanation of the Plates.

is useful in abortion, in any of the first four or five months, to hook down the secundines, when lying loose in the uterus, when they cannot be extracted by the fingers or labour-pains, and when the patient is much weakened by floodings. 3. The large hook at the other end is useful to assist the extraction of the body, when the breech presents; but should be used with great caution, to avoid the dislocation or fracture of the thigh.

Fig. 33. A, represents the whale-bone fillet, which may be sometimes useful in laborious cases, when the operator is not provided with the forceps, in sudden and unexpected exigencies.

BB, two views of a pessary for the prolapsus uteri. After the uterus is reduced, the large end of the pessary is to be introduced into the vagina, and the os uteri retained in the concave part, where there are three holes to prevent the stagnation of any moisture. The small end without the os externum has two tapes drawn through the two holes, which are tied to four other tapes, that hang down from a belt that surrounds the woman's body, and by this means keep up the pessary. This pessary may be taken out by the patient when she goes to bed, and introduced again in the morning; but as this sometimes rubs the os externum, so as to make its use uneasy, the round kind, marked C, are of more general use. They are made of wood, ivory, or cork, (the last covered with cloth and dipped in wax): the pessary is to be lubricated with pomatum, the edge forced through the passage into the vagina, and a finger introduced in the hole in the middle lays it across within the os externum. They ought to be larger or smaller, according to the wideness or narrowness of the passage, to prevent their being forced out by any extraordinary straining.

DD gives two views of a female catheter, to show its degree of curvature and different parts.

Fig. 34. *a*, represents a pair of curved crotchets locked together in the same manner as the forceps. The dotted lines along the inside of one of the blades represent a sheath contrived to guard the point till it is introduced high enough: the ligature at the handles marked with two dotted lines is then to be untied, the sheath withdrawn, and the point being uncovered is fixed as in fig. 21. (Pl. cccviii.)

b, Gives a view of the back-part of one of the crotchets, which is 12 inches long.

c, A front view of the point, to show its proportional length and breadth.

d, The scissars for perforating the cranium in very narrow and distorted pelvises. They ought to be made very strong, and at least nine inches in length, with stops or rests in the middle of the blades, by which a large dilatation is more easily made.

Plate CCCX. fig. 35. gives an anterior view of the improved lever by Koonhuysen, an instrument now come into considerable reputation. Fig. 36. shows the same in profile. Fig. 37. the lever recommended by M. Baudelocque. Fig. 38. one of the blades of a lever recommended by M. Herbinaux, fixed in the handle. Fig. 39. an anterior view of the same blade with the strap. Fig. 40. the spout of the syringe, when the instrument is used for injecting oil, or any other liquid into the uterus. The following is a general description of Roonhuysen's lever, with the method of using it, as given by M. Preville, and added to his edition of Smellie's Midwifery. "The lever is an oblong piece of iron, 11 inches long, one broad, and about an eighth of an inch in thickness, it is straight in its middle for four inches, and becomes gradually curved at each extremity: the curves are of different lengths and depths; the edges are rounded; and the extremities for the space of an inch, and also the middle of the instrument, are directed to be covered with plaster, and then the whole of it to be sheathed with thin dogskin; taking care to avoid inequalities or folds, which might injure the woman or child. In using it, the accoucheur must introduce the fore-finger of his left hand into the vagina near the anus, to serve as a guide for the instrument, which must now be gently insinuated between his finger and the head of the child, taking care that no part of the uterus be included between the lever and the head. The instrument must then be moved to the right and to the left, to find where there is the greatest space, and in some degree to loosen and disengage the head; and then gradually carried round, until it comes under the pubes, lifting the end of it from time to time, to obtain a freer passage. The handle of it must now be raised, and the instrument gently shifted about, until the occiput is exactly lodged in its curve. The more completely and exactly the curve touches and embraces the head, the more speedily and easily the delivery will be effected. The instrument being thus firmly and equally applied to the head, the accoucheur must slowly and uniformly raise the handle with his right hand, while with his left he presses the middle of it downward; by this means the coccyx is forced backward, and the lower part of the pelvis is enlarged. By continuing to raise the handle of the lever and to press down its middle or centre, the head of the child is made to descend into the dilated cavity of the vagina: and this is commonly effected in a few minutes; when the left hand must be applied firmly against the anus and perinæum, forcing those parts upwards and forwards towards the orifice of the vagina, to prevent laceration; for which purpose also the whole operation must be performed slowly and cautiously, imitating as much as possible a natural labour."

"We found (add the authors of the paper,) a cord fixed round one of the ends of the instrument, about the middle of the curve. This cord, we imagine, served no other purpose than to point out the end of the instrument commonly made use of, or to measure the length of the part introduced."

END OF THE ELEVENTH VOLUME.

Fig. 24

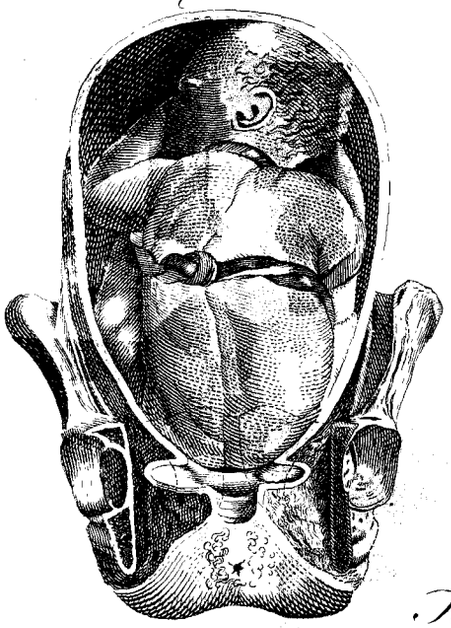


Fig. 25

Fig. 32

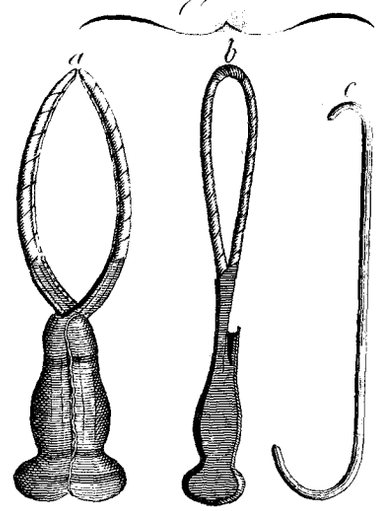


Fig. 26

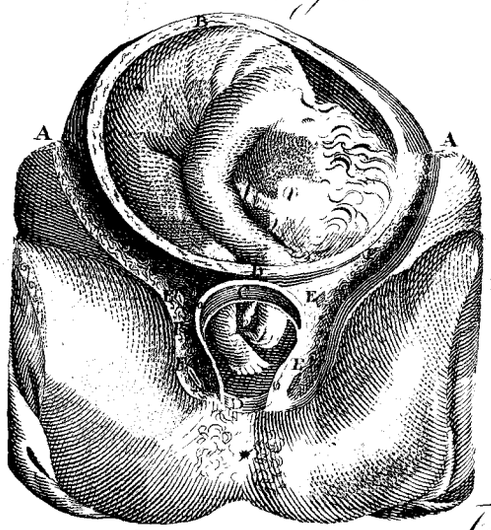


Fig. 33

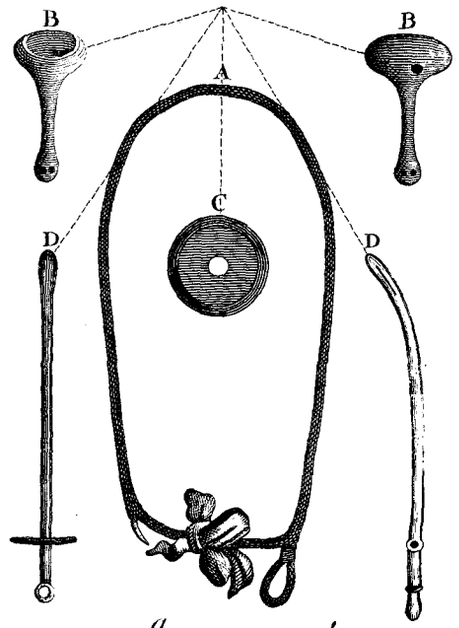


Fig. 27

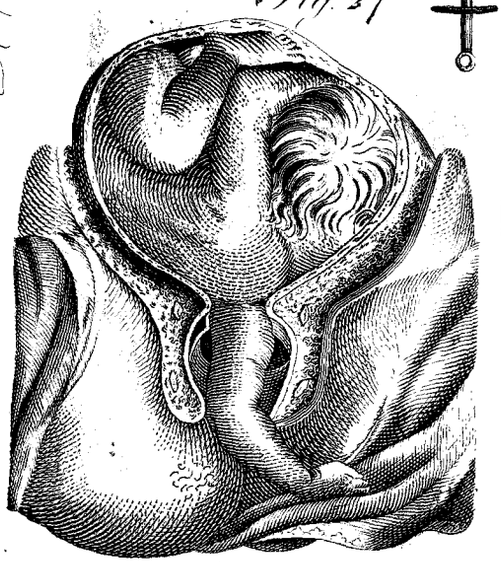


Fig. 28

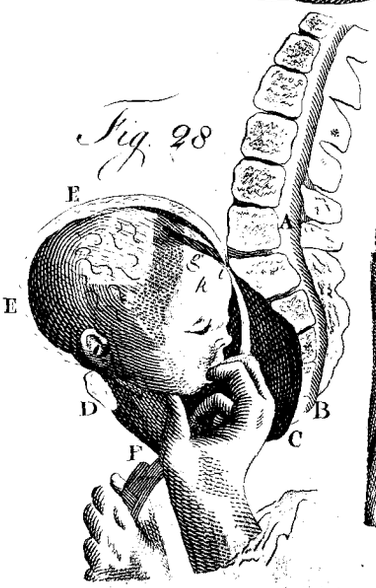
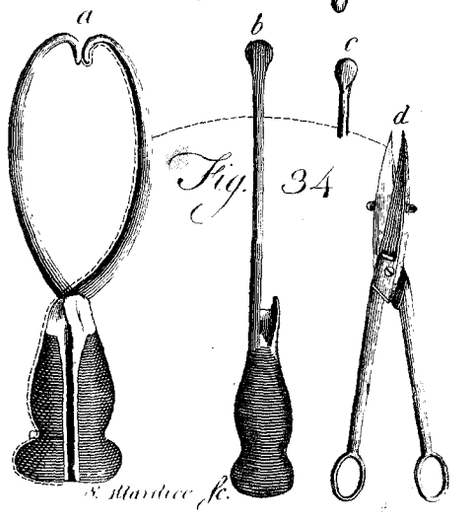


Fig. 34



S. Mardice fc.

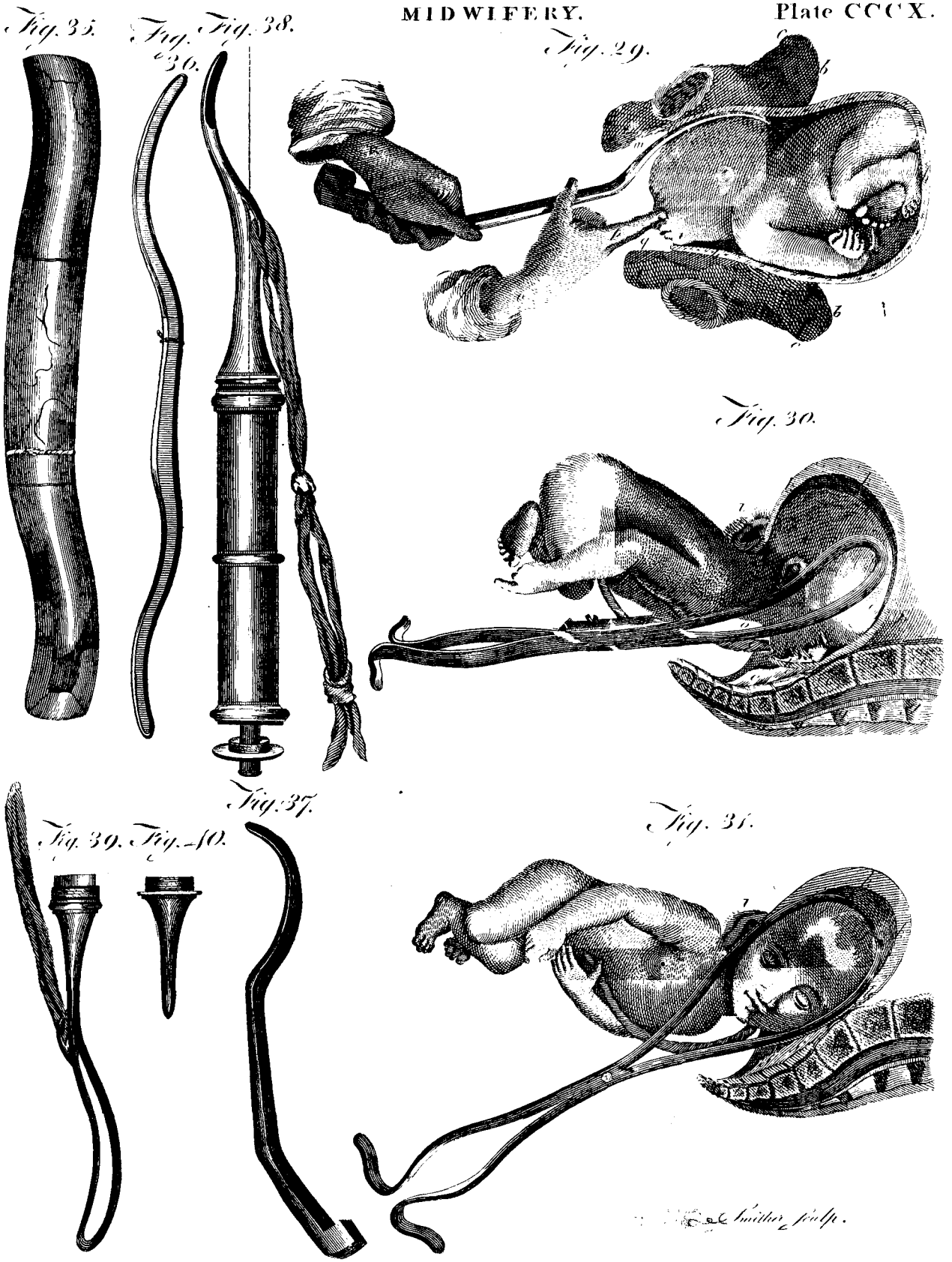


Fig. 35.
Fig. 36.
Fig. 38.
Fig. 29.
Fig. 30.
Fig. 37.
Fig. 39.
Fig. 40.
Fig. 31.